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VOLUME I *Chicago Number* NUMBER 5

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THE MEDICAL CLINICS
OF
NORTH AMERICA

VOLUME 1 NUMBER 5

CLINIC OF DR. CHARLES LOUIS MIX

MERCY HOSPITAL

AORTIC REGURGITATION, AORTITIS, AND ANEURYSM ON A SYPHILITIC BASIS. FUNDAMENTAL PRINCIPLES UNDERLYING THE DIAGNOSIS OF THE MORE COMMON CARDIAC LESIONS

BEFORE taking up the history of the patient to be shown it may be well to consider some of the fundamental principles underlying the diagnosis of the more usual cardiac diseases. If we have a clear conception of these principles, the diagnosis of the individual case becomes comparatively easy. Leaving out of consideration congenital heart lesions and such as are due to disturbances of cardiac innervation, thyrotoxicosis, pericarditis, etc., the great majority of cardiac lesions will be found to divide themselves readily into four great groups—the so-called rheumatic hearts, the syphilitic hearts, the renal hearts, and the arteriosclerotic hearts. This rather simple classification was suggested by Richard Cabot, and affords a most excellent basis for diagnosis in the individual case.

1. **Rheumatic Heart.**—By a rheumatic heart we mean a heart in which the endocardium has been affected by some infectious germ. Although the term "rheumatic" is applied to it, it is really the heart of metastatic infection. Usually it is found in association with tonsillitis and acute articular rheumatism, or it is a sequel of chorea. It may be rather latent in origin, but, as a rule, it begins shortly after a systemic infection of the body. The

germs, finding lodgment primarily in the tonsils, may infect the organism and be carried by the blood-stream to the heart. The organisms are then carried into the coronary arteries and, passing through the finer branches, ultimately reach the vulnerable portions of the cardiac anatomy. It was long since shown by E. A. Rosenow that the most vulnerable point is located just beneath the auricular surface of the mitral valves. Here beneath the upper surface of one or both mitral flaps, where there is, on the whole, the most insufficient blood-supply of any portion of the heart, the germs find their resting-place and begin their nefarious work. They first cause an interference with the working of the valve, permitting a slight amount of leak to take place. This occasions the systolic blow which we hear when we are in attendance upon a case of acute inflammatory rheumatism. The probabilities are that this murmur is due quite as much to interference with the sphincteric action of the auriculoventricular muscle-fibers as it is to deformity of the valves themselves. For a heart the valves of which are inflamed can hardly be expected to act physiologically as perfectly as the heart which has not been maimed. The first effect, then, in any case of mitral disease is to produce a faint systolic blow, heard usually best over the mitral area, and, as a rule, transmitted rather early toward the axilla, though it is sometimes heard even in the back at this stage. As time goes on the effect of the inflammation which the germs set up becomes more and more wide-spread. The result is that the valve becomes very lame in its workings, so that the leak is accentuated.

In the course of time an immunity may be acquired for the infecting germs by the organism and the infectious process may die out. This results, first, in the lessening of the inflammation, and, second, in the establishment of a certain amount of contractile and contracting scar tissue in the valve. The result of the contraction of this scar tissue is to pull asunder the edges of the mitral valve. Thus the leak becomes an organic one and can never be obviated by any kind of treatment. Indeed, it is axiomatic that mitral insufficiency thus resulting will never be cured.

The rheumatic heart may remain healed in this condition and

is permanently healed in a great many individuals whom we examine. These are the cases with the soft systolic blow who go through life with little or no difficulty and never suffer from shortness of breath, palpitation, or swelling of the feet or ankles, and who sometimes ask and obtain insurance from large insurance companies. Such individuals acquire what is called "compensation." The left ventricle mildly dilates and sufficiently hypertrophies. It dilates enough to accommodate sufficient blood to supply the needs of the body and to allow for the regurgitation of a small amount backward into the auricle. It hypertrophies to an extent great enough to propel without effort this increased amount of blood.

In this stage the heart may remain indefinitely, but it not infrequently happens that the process does not heal in the form of a permanent mitral insufficiency, but at a subsequent period a reinfection or recrudescence of the original infection takes place. If so, there is added to the original difficulty an associated mitral stenosis. This is brought about by reason of the fact that a greater amount of inflammation in the auricular valve either fastens the edges of the valves to one another, or leads to a general contraction of the left auriculoventricular septum. Thus, in mitral disease, mitral stenosis is merely an advanced stage of mitral insufficiency. The old authors—von Leube, for example—used to assert that if you make a diagnosis of mitral stenosis, the diagnosis of mitral insufficiency should go automatically with it; that a mitral valve which is narrowed will always be a mitral valve which will leak. The converse statement, of course, was not made, namely, that a leaky valve will become a narrowed one. We all know that leaking valves may remain merely leaking valves, but many individuals find out later in life, to their cost, that a leaking heart has within it the power of becoming a stenosed heart.

In mitral insufficiency a characteristic feature is a comparatively normal pulse. It is scarcely affected by the cardiac lesion. There is no change in the rate, tension, rhythm, or quality. It is neither fuller nor larger, nor emptier nor smaller than a normal pulse. It deviates so little from the normal pulse that even ex-

perienced observers would not by the pulse alone be able to postulate the probable existence of mitral insufficiency. In mitral stenosis this is not true. The pulse is profoundly affected both as to rate, rhythm, and quality. Later investigations have shown excellent reasons for this changed pulse, and this leads us briefly to discuss what we know concerning the mechanism for maintaining cardiac rhythm.

As all medical men now know, the pace-maker of the heart, the sino-auricular node, is located in the right auricle, at the junction of the auricle and superior vena cava. When the auricle contracts, because of the pace-maker, it sends its impulses down the bundle of His in the intraventricular septum. This bundle as it passes down divides in a Y-shaped manner, one portion going to the fibers of the right ventricle and another portion to the fibers of the left ventricle. Thus, an impulse originating in the auricle is carried along the fibers of the bundle of His and ultimately forces into activity the muscular fibers of the ventricles. The time required for the passage of an impulse from the auricle to the ventricle is from one-tenth to two-tenths of a second. The disturbance of this mechanism results in a mild degree of heart-block—the As.-Vs. interval being increased beyond two-tenths of a second.

Late studies made by Paul White have shown that in cases of well-compensated mitral stenosis disturbances of the bundle of His occur in quite a large number of cases, constituting, in reality, a mild degree of heart-block. In mitral stenosis the marked inflammation of the mitral flaps often spreads to the bundle of His and so disturbs the cardiac rhythm; or it may exert a perverted physiologic influence upon it at least. If, for example, we are treating a case of what seems to be pure mitral insufficiency, and we find that without any sign of a break in the compensation the pulse-rate has become rather fast and that there is some departure from perfect rhythm and some variation in equality of the pulse itself, we should be justified in inferring that an extension had probably taken place in the mitral insufficiency case in the direction of the establishment of a secondary mitral stenosis. Before the stage of the well-known diastolic murmur

of mitral stenosis a suspicion of a possible narrowing might be gained by careful pulse examination. The electrocardiogram is not wholly necessary. Estimation can be made usually fairly shrewdly with the cultivated sense of touch.

In the earliest stages, therefore, of mitral stenosis probably the only change that can be detected is the slight variation or tendency to variation from normal on the part of the cardiac rhythm. As time passes on, however, there is added to the picture the presence of a diastolic murmur. This diastolic murmur in an early developing case of mitral stenosis is really a presystolic murmur, taking place at the extreme end of diastole and just before the beginning of systole. It would seem as though the left auricle succeeded in pouring the first portion of its charge of blood through the mitral orifice into the left ventricle without the production of eddies, until ultimately the last remaining portion is forced rather rapidly through the narrowing valve, thus producing eddies in the ventricular blood and so causing a presystolic murmur. It is safe in the presence of a presystolic murmur in the great majority of compensated cases to assume that we are dealing with a comparatively early or first stage case of mitral stenosis.

In the course of time, when the narrowing of the valve becomes greater, the murmur stretches backward into diastole and the pulse becomes rapid, habitually arhythmic and unequal, and the murmur becomes frankly diastolic in point of time. Ultimately in some cases of a so-called third degree of mitral stenosis the opening between the valves becomes so narrow as to be hardly more than a buttonhole slit, the approach from the auricle through the valves into the ventricle being almost funnel shaped by reason of the changes which have taken place in the mitral flaps. When this stage is reached there is usually marked anatomic or physiologic involvement of the bundle of His, so that one finds in such cases very marked arhythmia and inequality, and frequently the evidence of heart-block, either in the sense of a lengthening of the As.-Vs. interval, or in the sense that there is an occasional absolute omission of the ventricular beat. These facts as to the pulse can often be picked up by the

finger if one is on the lookout for them. I do not mean to say that it is possible to diagnose heart-block by a sense of touch, but I do think it is possible in certain instances to suspect its presence with confident certainty.

Those of you who are conversant with older medical literature will remember that years ago it was taught by empirical therapeutists, notably Wood, that digitalis, while an excellent remedy in cases of mitral insufficiency, is contraindicated in cases of mitral stenosis. The work done by the physiologic therapeutists in the last few years on digitalis established the fact that it is of value in both cases, but the more recent work has led to the dictum that digitalis is contraindicated in heart-block. Inasmuch as in a certain proportion of mitral stenosis cases—possibly as many as 20 per cent. of all cases—heart-block exists, it is evident that Wood was right in insisting upon the valuelessness of digitalis in mitral stenosis in a certain proportion of his cases. Indeed, as the therapeutists know, strophanthus in mitral stenosis is apt to be far more valuable than digitalis. Although digitalis may work beautifully in some cases, in others it will not work at all. It will work in those cases alone in which there is no involvement of the bundle of His. It will not work in those cases in which there is such involvement.

In the "rheumatic" heart, then, you invariably have an inflammation which in the beginning affects the auricular surface of the valve-flaps, and which goes on to the production of an organic mitral insufficiency. It may stop at this point, heal up, and remain without further change during the individual's life, or the infectious process in the valve may light up afterward and go on to the production of mitral stenosis. The mitral stenotic disturbance may end in the first stage, in which there is merely a very slight presystolic murmur, or it may proceed to the second stage, in which there is a diastolic murmur, or to the ultimate third stage, in which there is a marked arhythmia, marked inequality of the pulse, rapid heart action, and great tendency toward passive congestion, especially of the lung and liver, and broken compensation, with secondary tricuspid insufficiency.

This is the picture of the rheumatic heart. It occurs in young individuals, and we do not expect to see it develop in people who have reached the fifth decade of life. We expect to find it in children who have had St. Vitus' dance or in young adults who have had tonsillitis repeatedly, or inflammatory rheumatism, or metastatic arthritis of one sort or another. We rarely ever expect to encounter it in later life, and if we think we do encounter it, we examine such suspects with the utmost care, because the probabilities are that we are mistaken. It is possible, then, almost at a glance, noting the age of the individual and his general appearance, to say that he, if he has organic cardiac disease, is more likely to be suffering from a rheumatic heart than from a renal, arteriosclerotic, or syphilitic heart.

Many of these rheumatic hearts do not stop merely with the development of mitral insufficiency and stenosis, and possibly at times tricuspid insufficiency, but in many of them the aortic valves also become affected. When they do, the flaps of the aortic valve go through precisely the same pathogenesis as the mitral valve. Aortic insufficiency first develops and it may persist indefinitely. The valves may definitely heal in this stage and no further trouble ensue, but, as in the case of the mitral valve, it very commonly happens that the process does not quiet down with the production merely of an aortic insufficiency, but goes on to the production of an associated aortic stenosis. Thus many a rheumatic heart is found to have all four valvular lesions with all four murmurs, a double mitral and double aortic lesion.

When in a rheumatic heart an aortic insufficiency develops, it does so almost invariably as a sequel to disturbance of the mitral valve. Although it is possible for primary rheumatic aortic insufficiency to occur with the preservation of the integrity of the mitral valve, still such an event is an extremely rare one. Almost invariably it happens that the mitral valve is first affected, then the aortic valve becomes secondarily affected. Just as when the mitral valve is affected the insufficiency first appears, so when the aortic valve is affected the aortic insufficiency first appears; but since this aortic insufficiency on a rheumatic basis in the vast

majority of cases occurs in the presence of an associated mitral insufficiency and stenosis, it happens that the picture of aortic insufficiency departs very much from the classical description. This brings me to the assertion that the medical text-book description of aortic insufficiency is not the description of "rheumatic" aortic insufficiency, but of syphilitic aortic insufficiency. Rheumatic aortic insufficiency differs tremendously from syphilitic aortic insufficiency. The two pictures are wholly unlike. In some text-books and by some writers the statement will be made that aortic insufficiency is notoriously missed by internists in their diagnosis; that postmortem examination frequently discloses the presence of aortic insufficiency when it was not diagnosed by the internist in charge. That may have been the case in the past, but it ought not to be the case now. Knowing as we do at present that rheumatic aortic insufficiency in the presence of double mitral disease is invariably atypical, that it never approaches the classical description of syphilitic aortic insufficiency in any manner, we should be on our guard; and, being on our guard, in looking for it we shall more frequently find it than we used to in the past.

When aortic stenosis is added to aortic insufficiency the changes in symptomatology and physical signs which it makes are very marked. Years ago von Leube enunciated three criteria as absolutely essential in the diagnosis of aortic stenosis. These three criteria are: (1) A loud, sawing systolic murmur transmitted upward into the neck; (2) a palpable systolic thrill over the second right interspace; (3) the absence of the aortic second sound. To these three criteria Broadbent added a fourth, namely, that the pulse of aortic stenosis must be a *pulsus tardus et parvus*, a pulse slow, not rapid, frequently not much faster than 60; a pulse in which the anacrotic arm rises very slowly, a *pulsus rotundus* with a round top, and a pulse with a very much diminished volume. If the aortic valve is narrow it is perfectly obvious that the left ventricle cannot deliver its charge of blood through the narrowed aorta as many times per minute as it could if the valve were wide open. It has not sufficient time to squeeze out all of its blood as it would have if the valve were undisturbed. Furthermore, it

cannot squeeze out through a narrow valve an amount of blood great enough to cause a good wave running down through the arteries; consequently, there is a *pulsus tardus et parvus*, slow and small. This pulse is one of the diagnostic essentials, if one is to establish a diagnosis of aortic stenosis.

Aortic stenosis is really a rare lesion. A systolic murmur in the second right interspace, soft in character, instead of loud and sawing, not associated with a thrill, not associated with the absence of the aortic second sound or with the changes in the pulse, is exceptionally common after the fifth decade of life. It never means aortic stenosis; it merely means aortitis. There is no chance for making an error in this respect if one remembers the criteria of von Leube. I do not mean to say that a beginning aortic stenosis must necessarily have associated with it all four of these criteria, but I do mean to say that they should be sufficiently developed in the ordinary case for one to be conscious of their presence, and thus to establish a diagnosis of double aortic lesion.

By way of a summary, then, the rheumatic heart is the heart of a young individual who has had some acute infection from which his cardiac malady is dated. It may be a chorea in childhood, or even a scarlet fever, though this is unusual. It is more frequently a tonsillitis or a "cold," or an acute inflammatory rheumatism. The first sign of its presence is a slight systolic blow heard in the mitral area and transmitted toward the axilla. It is transmitted in this direction because it is made in the left side of the heart, which lies behind the right side of the heart. The murmur cannot come through to the front of the chest because it is padded off by the right side of the heart, which is in front. It can escape, however, up into the armpit from underneath the heart, and so may be transmitted into the back of the chest. Thus we hear such mitral murmurs in two localities, the left axilla and the left back. The patient's heart may heal in this condition. He may for the rest of his life have nothing but the remains of his mitral insufficiency, but, unfortunately, in the great majority of cases an extension of the original disease takes place, and in the course of time, sometimes in a few weeks and

sometimes in a few years, there is added to the original mitral insufficiency a mitral stenosis.

Nor does the process stop here. Frequently it happens that an extension of the inflammation occurs to the aortic valves. If such an extension takes place the pathogenesis is always the same. There is first the production of an aortic insufficiency which may heal and remain healed indefinitely, or the morbid process may go on to the production of an associated aortic stenosis. "Rheumatic" aortic insufficiency in symptomatology and physical signs is very unlike the description of the aortic insufficiency of the text-books. The reason for this is that up to the present time the aortic insufficiency of the text-books has always been syphilitic aortic insufficiency, whereas there are two varieties of aortic insufficiency almost as different as daylight is from dark—rheumatic and syphilitic. The description of aortic insufficiency should be entirely rewritten from this point of view, and we should no longer speak of abstract aortic insufficiency. We should speak of rheumatic aortic insufficiency on the one hand and of syphilitic aortic insufficiency on the other.

In most cases, therefore, a glance at the individual will lead you shrewdly to infer the probable presence of a rheumatic heart, on the one hand, or of a renal, syphilitic, or arteriosclerotic heart on the other. The age of the individual will go far in leading you to a preliminary determination. The history of the individual will tell you a great deal. If he has a heart which had bothered him in earlier life or for years, or which has interfered with his getting insurance during the third decade of life, it is almost certain that the patient is suffering from a rheumatic heart.

2. **Syphilitic Heart.**—A syphilitic heart, to adopt a Hibernicism, is not a heart at all—it is an aorta. Of course, syphilis does affect the heart, especially in the acute cases, when there is produced a syphilitic myocarditis. Sometimes a syphilitic myocarditis crops up some years after the initial lesion, usually as a dyspnea of sudden, mysterious origin occurring in an adult somewhere around the fortieth year, who has been previously perfectly sound as to his heart. Such a sudden onset of dyspnea

associated with rapid heart action in a man in the forties ought always to raise in the examiner a suspicion of specific origin.

As I have already stated, however, a syphilitic heart, in general, is an aorta. By that I mean to say that when the spirochetes attack the cardiac mechanism they really first attack the arch of the aorta. They seem to have a predilection for the ascending portion, though they often, of course, attack the transverse and descending portions and, indeed, any or all of the arteries of the body.

Syphilis is a great dilator. Its effect is invariably to widen the aortic arch, to produce a weakening of the aortic wall, with subsequent stretching. It is a dilator *par excellence*. The dilatation may be so slight as to justify merely the diagnsosis of a dilated arch, or it may be great enough to merit the diagnosis of aneurysm of the fusiform type. Often it is a matter of taste with the examiner whether he shall designate a case syphilitic aortitis with dilatation, or syphilitic aortitis with aneurysm. There is no hard-and-fast line of demarcation between the two conditions. If the patient lives long enough the dilatation leads to the aneurysm.

When the spirochetes invade the aortic arch they not infrequently invade also the aortic valves, and when they do they always stick to their law of dilatation. Their effect upon the aortic valves is invariably to produce an aortic insufficiency. There is absolutely no such thing as syphilitic aortic stenosis. It is wholly contrary to the law of syphilitic pathology. If you have reason to suspect the existence of aortic stenosis in a case you are examining—if, for example, the criteria of von Leube are present and the pulse is a *pulsus tardus et parvus*—then probably your diagnosis is wrong and the case is rheumatic instead of syphilitic.

Many years ago Adolpf Strümpell called attention to the fact that there was the closest relationship between aortic disease and syphilis. When I first began to study medicine it was asserted that 45 or 50 per cent. of aneurysms were specific in origin. As time has gone on the percentage of syphilitic aneurysms has steadily risen, until now we feel sure that pretty nearly all aneu-

rysms are on a specific basis, comparatively few of them being due to senile arteriosclerosis or other very rare conditions. I remember very well when Strümpel first called attention to the association between tabes and aneurysm in support of his contention that both of these conditions were syphilitic in origin. We know now that such association is extremely common, large numbers of cases being met with in clinics constantly, especially since we have been freely making use of the fluoroscopic method of examination of aortic arches.

There is another interesting phenomenon connected with the syphilitic heart, and that is the very frequent association of angina pectoris with syphilitic aortitis. Great credit should be given to Clifford Allbutt for his early insistence upon the relative frequency of incipient syphilitic aortitic infection in angina pectoris. Now we know that many cases of angina are on a specific basis. It is now the rule for almost all examiners to insist that a Wassermann examination be made in all cases of angina. This rule of practice has been found to be essential because of the frequency with which syphilis has been found associated with angina. If I encounter a case of rather early angina with early signs of precordial pain, or a feeling of substernal compression, I invariably ask for a Wassermann test. To be sure, it frequently is negative when I have every reason to believe it should be positive. This is in accordance with the teaching of Warthin, who, in his work on syphilitic hearts at the University of Michigan, found large numbers showing spirochetes either in the myocardium or aorta in individuals who during life had given negative Wassermann reactions.

In whom do we find the syphilitic heart? We find it in men and in some women in the fourth or fifth decades of life. The story of almost all of them is that they have been well all of their lives as to their heart until comparatively suddenly, within a year or so, an almost complete cardiac breakdown has taken place. That leads us to the history of the individual whom we are going to show this morning, but before taking up his case, which will afford some additional information in regard to syphilitic hearts, we have further to consider the two remaining cardiac groups.

3. **Renal Heart.**—This is the heart of the individual who has reached middle adult life. It is the *cor bovinum.* It is the heart of high blood-pressure. Acute glomerular nephritis does not give rise to the so-called renal heart. The renal heart is the product of chronic interstitial or glomerulo-interstitial nephritis and of high blood-pressure. It is the hypertrophied heart, the heart with a very large left ventricle, the heart with a ringing aortic second sound due to the very high degree of back-pressure in the arteries. It is the heart which occurs in cases of polyuria, in cases in which the urinary output in the night exceeds the urinary output in the day. It is not the heart which shows many murmurs, for in the vast majority of cases none are found until the stage of dilatation from overstrain due to high blood-pressure is reached. It is not a difficult heart to recognize. Inspection of the individual will frequently lead you to judge the case as to type.

4. **Arteriosclerotic Heart.**—The arteriosclerotic heart is the heart of the aged. I do not mean by this that the individual must be aged in the sense that he is old in years, but I do mean that he must be aged in the sense that he is old in his arteries. He is the individual with a marked tortuosity of the temporal arteries, the individual who has begun to lose weight or who is already under weight, the individual with the moving brachial arteries and tortuous radials. Not infrequently his blood-pressure is not especially high. In many instances it may not be much above 130 mm. systolic, but he betrays his arteriosclerosis in other ways. It affects oftentimes his coronary arteries or his brachial arteries, and not infrequently his renal arteries. It affects his whole body, leaving it undernourished, and causing a gradual loss of weight. It is usually a comparatively easy matter in looking at the individual who complains of his heart to tell whether he belongs to this arteriosclerotic type or not. His appearance and age alone carry great weight in the final estimation.

If, then, you are confronted with an individual who is making some complaint as to his heart, the first thing for you to do is not to have him take off his coat and vest and roll up his shirt so you may apply the stethescope, but your first duty rather is

to inspect the individual as a whole, to size him up and make a mental estimate, to ask yourself whether in your opinion he belongs to the rheumatic group, the syphilitic group, the renal group, or the arteriosclerotic group. You will be surprised in the vast majority of cases to see how rapidly you can answer this question. You will find that you can conclude with a high degree of probability by your inspection of the individual as a whole that he belongs in such and such a group. This greatly simplifies the work which you will have to do when you examine his heart. You approach your patient understandingly; you already know before you begin to examine him a good deal about him. You may even be able to make a diagnosis without examining him. For example, suppose you look at a young man or a young woman about thirty-three or thirty-four years of age who is complaining of shortness of breath, and you pick up the hand and feel of the radial pulse and find an arhythmia and inequality, a rapid heart action, and a pulse which is somewhat small—possibly a thready pulse—you will have no difficulty whatever in saying off-hand that the young lady is suffering from a double mitral lesion, so characteristic is the pulse of this condition. On the other hand, if you meet with a man about forty-five years of age whose arteries are throbbing quite a bit, whose radial pulse shows quite a high anacrotic arm, a *pulsus acuminatus* at the top, with a sharp descent of the dicrotic arm, a *pulsus celer et altus*, the water-hammer or Corrigan's pulse, you know at once you are dealing with a syphilitic aortic insufficiency. Such a pulse could not belong to an aortic insufficiency on a rheumatic basis; it could only be a syphilitic aortic insufficiency. You would not get in such a quick diagnostic estimate, for example, all the details of the development of his lesion, but you would have a primary working basis for an attack upon the diagnostic problem, and you could work up the conditions actually present in his case at your leisure.

This is a rather lengthy preliminary statement of the fundamental principles to be had in mind when one approaches a cardiac case, and will make for us the demonstration of the present patient a matter of comparative simplicity.

The patient is a man fifty-seven years of age. He is unmarried and by occupation a waiter in one of the clubs of this city. For several years he has been engaged in this occupation. His habits are those of the class to which he belongs. He has consumed a fair amount of alcohol in his life. He has used all the tobacco that he wished, and although he does not admit having had a specific lesion, still, he is an unmarried man with a history, which he frankly admits, of gonorrhea. He entered the hospital October 16th because he was unable to work any longer.

Let us see how he was before the onset of his present illness. Every year up to this last year he has been able to work without any particular difficulty, but comparatively suddenly he has been taken with shortness of breath and general weakness so great that he has been unable to carry on his occupation as a waiter, and has come to the hospital for assistance. He does not complain of very much in the way of symptomatology except for one thing. He complains that he is bothered with a certain amount of compression in his chest; as he expresses it, "he has not room enough in his chest" or "he feels crowded in his chest." This has been associated also with some definite pain located in the so-called precordial area, although, as a matter of fact, it ought rather be called in his case the supracordial area, since the pain lies rather high instead of at the level of the heart. He does not admit, however, that the pain has extended into his left arm or that it has come down the ulnar nerve territory into his little finger, as so often happens in true angina pectoris. He does notice a fact which many of these patients observe, namely, that the pain bothers him quite a bit at night. He also has observed that exercise makes his shortness of breath much shorter, and that circumstance has compelled him to give up his work and come to the hospital for relief.

On entrance, the night of the 16th of October, his pulse was 92, his temperature 96.4° F., and his respirations 26. He walked into the hospital, but was immediately put to bed on account of the dyspnea which was present, and a back-rest was ordered because of orthopnea. During the day his respiration was very difficult and at night he became so very much distressed that

it was thought advisable to give him ¼ grain of morphin sulphate at 10 P. M. Notwithstanding this, he slept but four hours during the night. He was also put upon the infusion of digitalis, in the hope that his heart might be somewhat strengthened. You will note that the rate was not particularly rapid, the pulse being only 92.

The next morning, on the 17th of October, his pulse had dropped to 84, but his temperature still remained subnormal, being but 97° F. in the forenoon and 96° F. in the afternoon. His respiratory rate dropped very little, being 24 practically all day. He was much distressed during most of this second day, but managed to sleep quite a good deal. That night he was so far improved that it was unnecessary to give him any morphin, and the nurse reported that he had a fair night, although he did not sleep very well.

The urinalysis which was made the day after his entrance showed a specific gravity of 1021, an acid reaction, no albumin, no sugar, no red blood-cells, and an occasional small, narrow, hyaline cast. Two days later a similar analysis showed practically the same findings, except that the hyaline casts were much reduced in number, and by October 22d they had entirely disappeared.

The patient entered in a condition of extreme dyspnea on the afternoon of October 16th, and with rest in bed by the afternoon of the 19th was so fairly comfortable that he was permitted to sit in a chair while the bed was being made, and was also permitted to read. On the following day, the 20th, or the fourth day after he entered the hospital, he was in such good condition that he was taken to the *x*-ray room for fluoroscopic examination. Thus, four days of rest, a small amount of infusion of digitalis and an opiate given but once so improved his condition that he could read, sleep, and eat without very much trouble. On the 18th, the second day after his entrance, he was placed upon iodid of potassium because of the nature of his malady. Examination of the blood, which was ordered immediately upon his entrance because of the general picture which he showed, gave a 4+ Wassermann. A count of the blood showed 8400 white cells,

5,428,000 erythrocytes, and 80 per cent. hemoglobin. This indicates a fairly good blood state.

Very interesting is the observation made in regard to his blood-pressure. Although his heart, as we shall subsequently show, was in a state of distention, he has a systolic blood-pressure of 160. In taking his diastolic pressure the laboratory assistant records that it is greatly decreased, being under 50. The pulse-pressure, therefore, is 110.

You will notice that the individual is a man rather tall and well developed and apparently of the same age as he admits, namely, fifty-seven. You will note that he is rather short of breath, and yet that he is able to appear before the clinic without very much evidence of respiratory or circulatory embarrassment. When we proceed to examine this individual we are struck at once by the fact that the apical pulsation is located in the sixth interspace and that it lies in the nipple line. Such downward and outward dislocation of the apex is almost invariably found in one of three lesions—either in renal, arteriosclerotic, or syphilitic hearts. It is not found in the rheumatic heart. The rheumatic heart is the wide heart, and the apex is usually pushed far out into the fifth interspace. It does not sink into the sixth interspace. So diffuse an apex-beat as you note in his case is always a sign of dilatation, hypertrophy, or a combination of both.

Besides the apex-beat you will also note a very spectacular phenomenon, namely, an excessive pulsation in his carotid arteries. You will notice that they almost jump at you and, indeed, the term "hopping carotids," introduced by the French school, is very apt in describing these arteries. You will also notice when looking at his brachial arteries that they are somewhat tortuous and with each pulsation they snake out straight, and then revert to their former position, thus causing a certain degree of apparently lateral motion. You will also notice in observing his brachial arteries that there is a certain amount of arhythmia. Please note this fact, as it has some bearing on the prognosis, as we shall see later. If you will feel of his pulse as his arm hangs down, you will find that he has the water-hammer

or Corrigan's pulse, or, using the Latin term, he has the *pulsus celer et altus*. If you feel of the pulse with the arm elevated you will find this phenomenon still better exemplified. You will also note that the pulse is unequal as well as somewhat arhythmic.

In this connection please recall his blood-pressure findings. The systolic blood-pressure was 160 mm. of mercury, the diastolic less than 50, and the pulse-pressure 110. Pulse-pressure, in general, is an expression of the extent of throbbing. When the individual has a very low diastolic and very high systolic blood-pressure he always has what he calls "throbbing," namely, a very large discrepancy between the systolic and diastolic pressure, and the arteries even jump when they pulsate. Such throbbing is sometimes so great in aortic insufficiency that the pulse-pressure actually equals the systolic pressure. By that I mean that in many cases of aortic insufficiency the systolic pressure may be 160 and the diastolic 0. Since the pulse-pressure is the difference between diastolic and systolic, the pulse-pressure in some cases of aortic insufficiency may be 160 or even more. Zero diastolic pressure is pathognomonic of aortic insufficiency on a syphilitic basis. It does not occur in rheumatic aortic insufficiency.

Throbbing may also occur in cases of vasomotor paresis or vasomotor excitation. Such throbbing, if you take the blood-pressure at the particular time it occurs, is always found to be due to a marked discrepancy between the diastolic and systolic blood-pressure. In the case of chronic interstitial nephritis with approaching cardiac weakness throbbing frequently occurs. As such a patient gets better you will always notice that the diastolic and systolic begin to approach one another, and when the throbbing ceases you will find that it is because the discrepancy between the systolic and diastolic readings has been greatly lessened. In this man's case the very low diastolic and high systolic reading is extremely suggestive of syphilitic aortic insufficiency. Indeed, one might almost base the diagnosis upon this fact, taking also into consideration the man's general appearance and his brief history.

When you percuss his heart you find that he has a moderate

cor bovinum. The heart is enlarged considerably, extending to the right of the sternum about 1 inch and extending to the left of the nipple line. The dulness is found as low as the sixth interspace and as high as the second. Indeed, the dulness which one finds in the upper part of his chest is such as to raise the presumption of possible enlargement of his aortic arch, either in the sense that he has a dilated aorta or that he has an aneurysm. When you percuss in the second interspace to the right of the sternum you find slight dulness there. Huchard, years ago, called attention to dulness in the second right interspace as a sign of aortitis, and his observation has stood the test of time. Thus far in our examination we have evidence that the pathologic process has reached a high degree of cardiac hypertrophy, perhaps of dilatation, with the usual obvious signs of syphilitic aortic insufficiency.

On listening to his heart we are at once struck with the fact that we are hearing a number of murmurs. When we listen over the apex of the heart we hear a systolic and diastolic murmur. When we listen over the base of the heart in the second interspace to the right of the sternum we also hear a systolic and diastolic murmur. Has this man a rheumatic aortic insufficiency and stenosis and a rheumatic mitral insufficiency and stenosis? In answer to that question we would call attention to the fact that he has always been well until the last few months, and within a comparatively short time he has gone all to pieces as far as his heart is concerned. This is not the story of rheumatic heart disease. We find, on questioning him further, that he has not been the victim of any acute infection which could have as its sequel a rheumatic infection of his heart. It seems, then, altogether unlikely that he has a rheumatic double mitral and rheumatic double aortic lesion. Furthermore, when we listen to the aortic area more carefully we at once discover that von Leube's criteria, which are so important in the diagnosis of aortic stenosis, are not present. It is true that we cannot hear any aortic second sound in his case, but it is equally true that he has no loud, sawing systolic murmur over the second right interspace transmitted up into the right carotid artery, and that he has no

palpable systolic thrill in this location, and, finally, that he has not the characteristic pulse described by Broadbent, the *pulsus tardus et parvus*. Moreover, on feeling of his pulse any one of the gentlemen here would at once say that it would be impossible for a pulse of this character to be present if there were an associated aortic stenosis. His aortic systolic murmur then must be due to another thing. It cannot be due to an aortic narrowing. It must be due to an aortitis. When we fluoroscoped him we found that an aortitis is present to a degree so great that in my opinion we would be justified in making the diagnosis of fusiform aneurysm of the ascending arch.

On further auscultation we note a diastolic murmur, indicating aortic insufficiency. This leads us to another consideration. It used to be taught that an aneurysm, fusiform in type, of the ascending arch dilates the ring of insertion of the aortic semilunars to such an extent that they no longer touch when closed, thus causing a "relative" aortic insufficiency. When I first began to study medicine we were carefully taught that in practically all cases of aortic insufficiency the ascending arch was involved because of a relative dilatation of the ring of insertion of the aortic semilunar flaps. We know now this is not the case. Examination of these valves by the Levaditi staining method shows that they contain spirochetes, and what we used to call "relative aortic insufficiency" is now known to be organic spirochetic involvement of the valves. Consequently, we know that this individual, although he has either a fusiform aneurysm or a dilatation of the ascending portion of the aortic arch, is not suffering from "relative" aortic insufficiency, but from true organic insufficiency.

Remember also what I said a short time ago, namely, that there is no such thing as syphilitic aortic stenosis. It is wholly contrary to the nature of syphilis for an aortic stenosis to develop; and when, in the presence of an obscure case of syphilitic aortic insufficiency, you think you find signs of aortic stenosis because of a systolic murmur, hesitate long before you make the diagnosis. In fact, do not make it, for if you do you will be wrong.

Now let us turn our attention to the mitral area. As I said,

you also hear fairly readily in this locality two murmurs, a systolic and a diastolic. They seem to be, to all intents and purposes, quite excellent evidences of disease of the mitral valve, but if there be disease of the mitral valve, can a diagnosis of syphilitic heart stand? Our answer would be No. If there is disease of the mitral valve present in his case with the presence of true mitral stenosis and insufficiency, then his case is rheumatic and our whole diagnosis falls down.

When we examine carefully into his systolic murmur we find that it is not very well transmitted to the axilla. Furthermore, we find that it is not heard in the back. This is a matter of considerable importance because it means that the murmur is not characteristic of true mitral insufficiency. The murmur is not properly transmitted. Is it not just as reasonable to assume that his apical systolic murmur is due to a relative mitral insufficiency caused by gradually developing weakness of the muscle-fibers of his left ventricle, leading to dilatation of the left ventricle and a failure of approximation on the part of his mitral flaps? It is surely true that such a dilatation, with weakening of the sphincteric action of the auriculoventricular septum makes possible the regurgitation of blood from the left ventricle into the left auricle, producing what is called relative mitral insufficiency, or the relative insufficiency of cardiac dilatation. This, then, is the explanantion of the systolic apical murmur, not transmitted to axilla or back.

How, finally, are we to explain the diastolic murmur which is heard at the apex? If you will note carefully this diastolic murmur you will observe that it is not associated with a loud, rolling, or reduplicated apical first sound. Can it be explained on any other basis than that of mitral stenosis? Yes, it is the so-called Austin Flint murmur. In aortic insufficiency the regurgitating blood-stream, shooting back from the aortic arch beneath the mitral flap into the upper posterior right-hand corner of the left ventricle, buoys up the mitral flap and opposes it to the blood which is passing at the same time from the left auricle into the left ventricle. The opposing of this flap to the downcoming blood-stream brings about an artificial narrowing of the

valve space between the left upper and left lower chamber. It therefore produces eddyings in the blood entering the left ventricle, and such eddyings are heard by us as diastolic murmurs. It is not that we hear the diastolic murmur of the aortic area carried by the blood-stream down into the left ventricle, but we hear at this level a real diastolic murmur undoubtedly produced in the left ventricle by the opposition of the mitral flap buoyed up by the aortic regurgitating blood to the oncoming blood from the left auricle into the left ventricle. That is how an Austin Flint murmur is brought about.

We have found in this individual an excellent example of how easily we may diagnosticate a cardiac case by going at it in the proper manner, whereas had we at once started to listen to all four of his cardiac murmurs, we might probably still be floundering around, wondering whether he is suffering from a double mitral and double aortic lesion or not. We perhaps would have entirely missed the great fundamental diagnosis of cardiac syphilis. Approaching the thing from a fundamental point of view we recognize a probable syphilitic in the individual. We note at once that he belongs not to the rheumatic group, but, by his age, either to the renal or syphilitic. We note by his history that he belongs at once either to the syphilitic or to the renal group, and as soon as we examine his urine we are cognizant of the fact that the case must belong to the syphilitic variety. The early determination of the Wassermann reaction was of distinct advantage, because we could then be positive of the presence of a specific infection. The fluoroscopic examination which was early made was also fortunate because it gave us early and indisputable evidence of aortitis and of a degree of dilatation great enough to warrant the diagnosis of aneurysm. Thus, as far as the diagnosis of this man is concerned, we would say that he is suffering from cardiac syphilis, that he has an aortitis and aneurysm and aortic insufficiency, that although he has four murmurs present, he has but one lesion, that the murmurs are easily, readily, and reasonably explained on the basis of one pathologic process, namely, syphilitic aortic insufficiency.

There remain two points which must be discussed rather

briefly. The first of these is his precordial pain and distress. This is an evidence of aortitis, and if it reaches a degree great enough will probably eventuate into true angina pectoris. It is, however, not likely that he will live long enough for the development of such a state of affairs. Sir Clifford Allbutt, in his book on Arteriosclerosis and Angina Pectoris, calls attention to the fact that the only constant pathologic lesion in all cases of angina pectoris is really an aortitis. The old concept that such an angina is due to coronary sclerosis or, in the event of failure to find it on postmortem examination, to angiospasm of the coronaries, this secondary hypothesis being necessitated by the absence of organic coronary sclerosis, has had to be abandoned. At the present time there seems to be a greater disposition to accept Allbutt's teaching that such anginas are occasioned by aortic disease. In his case, therefore, his precordial tightness is another link in the diagnostic chain. It was noted that in his case pupillary inequality, tracheal tug, an expansile tumor, and asymmetry and asynchrony of the radial pulses was not present. Large numbers of mild degrees of aneurysm occur in which these classical signs of aneurysm are wanting. Indeed, in the great majority of aneurysms at the present time we get our diagnosis from the fluoroscopic examination and the *x*-ray plates. When in the case of a precordial distress and anginoid symptoms our suspicions are still further raised by the presence of an aortic systolic murmur, the fluoroscopic and *x*-ray examination is an imperative necessity.

The second point which needs amplification is the presence in this man's case of arhythmia. What does an arhythmia mean in his case? Can it add anything to our diagnosis by its presence? You will recall what I said in regard to mitral stenosis and the effect of disease of the valve-flaps upon the bundle of His It will occur to you that it is a very simple matter, because of the propinquity of such disease in the mitral valves to the bundle of His, for a physiologic or anatomic disturbance to take place in this bundle. How is it with reference to the aortic arch? Can syphilis of the aortic arch with the production of an aortic insufficiency, aortitis, and aneurysm account for the arhythmia

by extension to the bundle of His? The answer is obviously that it cannot. The arhythmia must be due to some intrinsic disturbance in the heart itself. It has long been taught in textbooks that when in a case of aortic insufficiency arhythmia and inequality of the pulse are noted, there is likelihood of early death. This dictum was based entirely upon experience and was warranted by the event. Now the dictum is based upon better knowledge of cardiac disease. We know now that when such arhythmia develops in syphilitic aortic insufficiency, thanks to the work especially of Warthin for proving the presence of the spirochetes in the heart muscle, myocarditis is almost invariably present. What, then, must we conclude in the case of this patient? This, that in addition to the syphilitic aortic insufficiency, aortitis, and aneurysm, he is also suffering from a myocarditis of spirochetic origin. Will this modify the prognosis in his case? Yes, to a remarkable degree. Our experience in such instances is that these patients have not very long to live. They reach their primary cardiac breakdown; and, unlike the compensated cases in the rheumatic heart, the breakdown is a final breakdown. They may live one year, sometimes two or three, but rarely more than that after a syphilitic cardiac breakdown such as this patient has.

NOTE.—The patient was kept on cardiac and specific medication for quite a time, requiring occasionally, because of difficulty in breathing, doses of codein and occasionally also of morphin sulphate. Toward the end of the year he began showing edema in his lower extremities, which is notoriously a sign of great gravity in cardiac syphilis. It is a sign of great gravity because it means a vastly weakened myocardium. At the same time his respirations gradually became more and more labored, so that we noted on the 31st of December that there was a moderate degree of edema of the lower extremities, that his respiration was labored, and that occasionally he was irrational and tried to get out of bed. He also began complaining of pain, some of the pain being abdominal and extremely suggestive of abdominal aortitis and abdominal angina. During the forepart of January he became more and more irrational, trying to get

out of bed and talking at random and sleeping but very little. On January 8th he seemed much as usual, his pulse being 84 at 6 A. M. and 84 at 3 P. M. On January 9th he suddenly took a turn for the worse at 6 o'clock in the morning, but near the close of the day he was pretty much as usual, his pulse being 90, his temperature 96.8° F., his respirations 20. That evening he began to sink rapidly. His pulse rather suddenly began to be very rapid in action, rising to 130 at 7.30 P. M. and his respirations to 30. At 8 o'clock his pulse was 126 and respirations 26. At 8.30 P. M. his pulse was 80 and his respirations 20. At 8.45 P. M. his pulse had fallen to 76 and he was given a dose of camphorated oil. At 9 P. M. his pulse dropped to 54 and his respirations to 24, when he died. The observations in regard to his pulse are rather characteristic of a failing heart from myocarditis. The heart struggles along toward the end, beating fewer and fewer times per minute, until finally pulsation entirely ceases. His axillary temperature when taken shortly before his death showed a temperature of 97.8° F. There was no pulmonary edema or evidence of coronary embolism or thrombosis, or other disturbance of any definite sort. All that one can say was that he very gradually sank on the evening of the 9th day of January, dying at 9.05 P. M. No postmortem was permitted.

CLINIC OF DR. SOLOMON STROUSE

MICHAEL REESE HOSPITAL

JUVENILE DIABETES IN TWINS. THE KARELL TREATMENT OF EDEMA. THE IMPORTANCE OF DETAILS IN THE TREATMENT OF ANGINA PECTORIS.

JUVENILE DIABETES IN TWINS

THROUGH the courtesy of Dr. Julius Hess I have the privilege of showing you today a rather remarkable instance of diabetes occurring in twins at almost exactly the same time. The history of the two cases from birth is identical. The age of the children is eleven years, both were delivered normally, had an uneventful childhood, both had chicken-pox at the age of five, measles at six, and whooping-cough at eight. In the family history there is no diabetes, but on the mother's side there seem to be some cases of pulmonary tuberculosis.

The children entered the Michael Reese Hospital in January, 1918, and the mother gave the following story: A few weeks previously the little girl complained of irritation of the genitalia and increased thirst. Urine examination made by their physician showed sugar. Now because it had always been true that both children had suffered simultaneously from the same diseases, the mother had the urine of the boy examined, and sugar was found in his specimen also.

Going back a little, we find, on questioning the children, that the boy had several attacks of tonsillitis and had his tonsils removed in 1911. Likewise the boy confessed to being a great eater of potatoes and bread, while the girl does not like potatoes, but never missed an opportunity to eat as much candy, bread and jelly, and rich pastry as she could lay her hands on.

When the children first entered the hospital they were both very healthy looking youngsters, perhaps inclined to adiposity. The physical examination was absolutely negative in both children; the blood and stool examinations showed nothing abnormal.

The urine, however, showed a reducing substance, which Dr. Morse analyzed and proved to be glucose.

I do not propose to go into the question of treatment of these children, as Dr. Hess will probably report the cases later. It is interesting, however, to note that they behaved to dietetic treatment in the same way that one would expect a diabetic child to behave. The carbohydrate intake has varied at different times and there was a corresponding variation in the glucose excreted. One examination of the blood-sugar was made in each child; in both instances the low figure of 0.06 per cent. was found.

It is certainly unusual to find diabetic twins. Many authors have reported diabetic families, but I have seen no instance reported similar to this. That these cases belong probably to the class of true diabetics would seem to be a justifiable conclusion from their reaction to treatment, despite the low blood-sugar. In recent years several investigators (Salomon, Riesman) have attempted to separate out of the group of youthful diabetics a mild type which is not severe or fatal. Unfortunately, this differentiation has not resulted in separating the cases of *true* but *mild* diabetes from those of *renal glycosuria*. Attention, however, has been directed to the fact that there may exist in children perhaps three different types of diabetes:

1. The true—usually fatal—diabetes.

2. A mild type of true diabetes, generally occurring in several members of the same family.

3. Renal glycosuria, which is not true diabetes, but is an anomaly of glucose excretion.

The cases presented here probably belong to either Class 1 or 2, but further study and observation of the clinical course would be necessary before definitely classifying them.

From the standpoint of etiology these patients also offer food for thought. In many of our patients a preceding history of an acute focal infection, usually in the tonsil, has been obtained. It is, therefore, interesting to note that the girl never has complained of sore throat and has perfectly good-looking tonsils, while the boy had his tonsils removed seven years ago. It

will, however, be noted that both children admit being heavy eaters of carbohydrate food, the boy of potatoes and bread, and the girl of glucose in the form of candy, jellies, and pastries. Coupling this fact with the incidence of the disease at the same time in children born at the same time, one might be tempted to speculate as to the etiologic relationship of excessive carbohydrate feeding to juvenile diabetes. In a review which I have recently made of the reported cases of diabetes in the young, many patients, especially the infants and very young children, gave a history of glycosuria following almost immediately after prolonged ingestion of a diet containing an excessive amount of carbohydrates. You may also recall the theory of Weichselbaum, that diabetic children are born with the pancreas congenitally predisposed to the pathologic changes which produce the disease. It is, indeed, quite conceivable that in our cases such a congenital predisposition may have existed, and that the continued insults of excessive carbohydrate feeding finally broke the barrier and damaged the pancreas sufficiently to produce glycosuria.

THE KARELL TREATMENT OF EDEMA

CASE I.—The patient is a dentist, aged sixty-one, married, who came to me in November, 1917, for an examination. He gives the following history: He has always been a healthy man, who worked hard all his life; he has never been an alcoholic, hardly drinking at all, and he absolutely denies any venereal infection. Up to November, 1914, he can recall no illness whatever except a slight backache resulting from trauma. Three years ago he had a "breakdown," and was put to bed and treated for myocarditis. Since that time he has been an invalid and complains of the following group of symptoms: Dyspnea on exertion, cough on lying down, a marked swelling of the abdomen, and a general inability to do things. His abdomen has been tapped at intervals of three weeks.

His family history is negative; there are several healthy children and his wife has had no miscarriages. On examination you will see a florid, healthy looking man. There are no dilated venules on the face, nor does his nose give any signs of acne

rosacea. The sclera are clear, the right pupil is slightly larger than the left, and both react well to light and accommodation. The throat is negative and the teeth are in good condition. A few small lymph-glands are palpable at the back of the neck on the left side; otherwise there are no enlarged glands any other place in the body. The thyroid is not enlarged.

Chest.—The lungs, except for a few coarse, moist râles in both bases posteriorly, are negative. The heart apex is beyond the nipple line and the heart is considerably enlarged both to the right and left of the sternum. The heart sounds are sharp and clear, and everywhere over the cardiac area a rough, systolic murmur is heard. There is no accentuation of the aortic second sound. Over the base of the heart and over the aorta this rough systolic blow is heard quite distinctly. The pulse is regular, of good volume, with a systolic pressure of 115.

Abdomen.—At present you notice many atrophic lines over the skin of the abdomen, which, although full, is soft and not distended. Palpation reveals no tender areas. The edge of the liver is easily palpable 4 cm. below the costal margin. The edge is round, very hard, and apparently nodular. No other abnormality is noted in the abdomen, and at present there is apparently no sign of ascites.

The reflexes are brisk, there is no edema of the ankles, and no scars or tenderness over the long bones. A plain specimen of urine just voided shows a specific gravity of 1021, a trace of albumin, no sugar, and a few granular casts. The blood examination reveals nothing abnormal and the Wassermann test is negative.

Diagnosis.—From the history of this man we are practically forced to make the diagnosis of cirrhosis of the liver. Allow me to recall that for months, up to August 4, 1917, the abdomen was tapped regularly every three weeks and much ascitic fluid removed. It is true that this patient has myocarditis, that he also has a disturbance of his renal function, but it is hardly probable that either myocarditis or nephritis could result in the present condition of the liver and the repeated filling of the abdomen with ascitic fluid. Likewise the occurrence of the

aortitis, which is evident from the physical signs in the heart, would support the presumption that here we had a case of cirrhosis of the liver. Now, despite the negative Wassermann and the negative history of syphilitic infection, the probabilities are, of course, that the cirrhosis of the liver is due to the Spirochæta pallida, especially in view of the complete absence of any alcoholic history.

Treatment.—When this patient came to me he was in a condition such as you see him now. That is, his heart was compensated and there was no ascites, and, as a matter of fact, he had been in such a condition for over three months, although up to August 4th he had to be tapped every three weeks. What happened to cause this remarkable change? The patient had read somewhere about the Karell treatment for edema, and, on his own initiative, without the guidance of a physician, had decided to indulge in this treatment. He followed a strict "cure," and for over a week at a time he took nothing but 28 ounces of milk a day. We will discuss the details of the method later. In this case a really remarkable result ensued. The ascites gradually disappeared, the man lost much weight, his girth became so small that he had to have his trousers retailored, and, on the whole, he felt in much better condition physically than he had for years. After the acute stage of the treatment he followed a strict diet in which the salts and water were both limited, and up to February of this year succeeded in preventing the onset of ascites. About the middle of February, despite a rigid adherence to a milk régime, the ascites had again developed to such an extent that tapping had to be resorted to.

Before discussing the details of the treatment in this case I wish to show you another example in which by means of diet we were able to relieve a patient of general anasarca.

CASE II.—This gentleman is seventy years old; a man of exemplary habits all his life; there has been in the past two years or less a gradual development of a tendency to dyspnea on exertion, an irregular pulse, and a dilated heart. In his past history there is nothing of particular importance except an operation about fourteen years ago for a ruptured cecum. At this time

the man was desperately ill and only survived after a most trying and critical time. As stated above, he has always been of exemplary habits, never indulged in alcohol at all, smoked but rarely, and denies venereal infection. All his life he has taken good care of himself, and although engaged in the pursuit of big business he has for years not done any hard physical work, and has almost invariably had a daily period of both physical and mental relaxation. He is the father of three healthy children and his wife has had no miscarriages.

Last winter he was continually under the care of physicians and practically constantly under the influence of digitalis in some form or other. Despite this constant care and attention. in the spring his dyspnea became more marked, and in July there was a beginning edema. Up to this time the patient had not been kept completely in bed, as it had always been felt by his physicians that no considerable harm could result from allowing him a couple of hours of business daily. When I saw him in July, through the courtesy of Dr. Otto Schmidt, the dyspnea was so marked that it was necessary to put the patient to bed.

Physical examination at that time showed our patient sitting up in bed, propped by pillows, with rapid, labored breathing; there was distinct puffiness around the eyes, the face gave a general impression of being bloated, there was no cyanosis. The pupils reacted to light and to accommodation and there was a decided subicteric tinge to the sclera. The tongue was heavily coated, the pharynx was normal, and except for one or two teeth that seemed to be in poor condition there was no dental pathology. No glands were enlarged, the thyroid was normal.

Chest.—The lungs showed a definite impairment of the percussion note in the right upper anteriorly and the right base posteriorly. The percussion note in the left base was also dull and merged into the cardiac dulness. On auscultation the breath sounds at the right upper were rough and expiration was prolonged, while over the bases of both lungs the breath sounds were markedly diminished posteriorly; anteriorly in both bases numerous coarse, moist, and mucous râles were heard.

Heart.—The heart apex could not be made out, but there

was a fluttering impulse in the fifth interspace extending practically from the nipple line to the mid-axilla. Owing to the mergence of the dull note due to fluid in the left pleura with the cardiac dulness it was absolutely impossible to outline the extent of the cardiac dilatation to the left. The cardiac dulness extended 4 cm. to the right of the sternal line. The sounds were weak, fluttering, with a marked arhythmia, and a soft systolic blow was heard at the apex. At the base both sounds were weak, neither one accentuated. There was no murmur over the aorta and no substernal dulness. The pulse was very weak, thready, and perpetually irregular; the blood-pressure was 105 systolic.

Abdomen.—The abdomen was full and distended; the liver was easily palpable at the level of the umbilicus, the edge was firm and quite sharp, and was not tender; the spleen was palpable as a firm, round, splenic tumor (patient's wife said that "the spleen has been present for years"). There was a scar of the previous operation in the right lower rectus region. There was some dulness in both flanks which was movable.

Extremities.—The reflexes were active and there was considerable edema of the ankles and legs beyond the knees.

The blood-picture showed a slight, secondary anemia, the Wassermann was negative. The urine excreted in twenty-four hours amounted to between 450 and 600 c.c. It was of a high specific gravity, 1027 to 1030, highly colored, and usually showed a moderate amount of albumin and varying amounts of casts.

Diagnosis.—The diagnosis in this case is plainly a myocarditis, with a dilated heart and no hypertrophy. Secondary to this condition is a generalized stasis of all organs, including the kidney, and a rather definite water retention. The etiology of the myocarditis is not clear; it probably was a premature senility. That the condition is hardly primarily renal would seem to be shown by the history and the findings at the time of the examination.

Treatment.—At the time the patient was first seen by us we had to treat a case of dilatation of the heart, with a complete cardiac breakdown. Bed rest, attention to the bowels, and daily mild sweat-baths were used. The patient was put on a diet con-

sisting of milk, cereals, toast with saltless butter, and orange-juice. The fluids were always limited and carefully measured and salt was practically excluded from the diet. Digitalis was used in various ways, but for five or six days there was a steady downward course.

At this time it was decided to employ an even more rigid dietary régime. The patient was allowed nothing but 28 ounces of milk, given in doses of 7 ounces each at 8, 12, 4, and 8 o'clock. At 6 o'clock in the morning a small cup of black coffee (3 ounces) was given, but nothing else was allowed to pass his lips except cascara at night. Not a drop of water was allowed.

This régime caused considerable distress to the patient, but was persisted in for four days. At the end of this time there had been no increase in the excretion of urine, but the patient had become gradually weaker, the pulse was of a decidedly poorer quality, and the heart sounds, if anything, even more fluttering than at the beginning of the treatment. Fearing the effects of too prolonged starvation, we then added to the diet toast with saltless butter and cereals. He was given two pieces of toast three times and two portions of cereal, with a little sugar and milk, twice in the course of the next two days. Tincture of digitalis in doses of 15 minims every four hours was also started. At the end of two days of this modified diet the desired effect was noted. The urine excretion increased from 500 to 700 c.c. the first day, 1200 c.c. the second, and even to 2100 c.c. on the third day; the edema disappeared practically entirely, the pulse became stronger, the cardiac dulness gradually but definitely diminished in size. However, and this is important to emphasize, the condition of the patient, on the whole, gradually grew worse. On the morning when the urine excretion had risen to 2100 c.c. a dose of Epsom salts was given and was followed by a rather extensive intestinal hemorrhage. Whether this hemorrhage was due to the effect of too rapid osmosis from an intestine already gorged with blood, or whether it was due to a mesentery thrombosis, or perhaps even had something to do with the previous intestinal operation, we could not say. It lasted for a few days, during which time, as a result of the hemorrhage and the pre-

vious starvation, considerable anemia and a condition of marked asthenia developed. This anemic and asthenic condition persisted for a long time after the hemorrhage ceased, although the condition of the cardiorenal system remained satisfactory throughout. The diet was gradually increased until the patient was getting practically everything in unrestricted amounts with the exception of sodium chlorid and of fluids. It was found very quickly indeed that in this case there was a decided limitation to the amount of water which the patient was able to handle. More than 900 or 1000 c.c. was followed practically immediately by edema and a lessened excretion of urine.

The subsequent course of our patient was a gradual but slow improvement of his general condition, and a return of cardiac function which permitted him to walk one-half to one mile at a stretch without dyspnea or difficulty of any sort. In fact, it was almost impossible to realize that this patient in September, walking around and taking care of his business, was the same man who in July was practically moribund from a dilated heart.

Discussion.—It is not always possible to show patients illustrating as well as these two do the power of properly selected diet. Our first patient, whose abdomen had to be tapped every three weeks on account of ascites, due to cirrhosis of the liver, is able to attend to his affairs for six months without the necessity of resorting to the paracentesis needle. The second patient for almost the same length of time is able to take care of big business affairs and lead a life at least of moderate comfort. It could hardly be expected, with the pathologic conditions existing in these two cases, that any treatment would give permanent results, and it is not surprising that both patients have had relapses, which will be discussed later.

The method of procedure to eliminate the retained fluid in both of these cases was the same. The use of restricted amounts of milk without the aid of medicine accomplished the result. The reasons which prompted employment of the restricted milk diet, which is known as the "Karell cure," are simple and logical. The retention of fluid is associated with retention of salt, and, in our cardiac case at least, was due to mechanical inefficiency

of the heart to pump the water through. Milk, as you well know, is an almost ideal diuretic food. It has definite food value, a limited amount of fluid, and a small amount of salt and protein. In addition, it perhaps has of its own accord a slight diuretic action. The one drawback to milk as an ideal food is that in order to furnish sufficient calories properly to nourish a person too much milk must be used. Therefore, in employing the small amounts of 800 c.c., which we use in the strict Karell method, we must realize that we are not giving the patient sufficient nourishment to maintain his body weight. A tremendous loss of body weight which follows a successful Karell cure is due, of course, in great part to the loss of the retained water. But at least in our second case its effect on the nutrition of the patient was quite noticeable, and recalls to mind the need for consideration of this point when we employ the strict régime.

It seems rather strange that the employment of milk and nothing but milk in the strict way outlined will often bring results which could not be obtained by the more liberal feeding. It is probably true that the preliminary treatment prepared the ground for the milk to get in its work. It is more probable, however, that the element of functional rest to the kidneys enters in any explanation of the efficacy of a restricted milk diet. The functional rest which would be obtained by the milk régime, theoretically at least, would be greater than that offered by the more liberal diet, and perhaps it is just this element which, in certain crucial cases, changes the balance in the right direction.

While these two cases illustrate how wonderfully efficient the Karell régime may be, they also illustrate two other points in its employment. The first of these points has already been discussed, namely, the possibility of producing asthenia, which is as serious as the original disturbance. As a general thing, however, one need not seriously consider this as a danger, because in the extreme case of anasarca anything that promises relief is welcome.

The other point is concerned with the permanency of the results. Neither one of our patients was *cured* by the treatment; yet one would be expecting a tremendous amount of any remedial

agent to effect a cure where so marked pathologic changes were present. Of course, a cure cannot be effected when such marked anatomic changes have already occurred. But the question will arise at once whether the milk régime is of benefit in a possible return of symptoms. This point I can answer in regard to both our cases. The dentist with the cirrhosis of the liver had absolutely no effect from the same method of treatment in February, which had proved so successful in August of the preceding year. The gentleman with the myocarditis, however, still reacts splendidly to milk. In the past two months there has been a constant tendency toward development of edema, as we have never been able to increase the patient's salt or water tolerance. Whenever the edema becomes threatening the patient is placed on milk, 7 ounces every four hours, for four doses a day, with 6 ounces of coffee for one or two days, and generally this has been followed by an increased urination and improvement in his circulation.

These two cases illustrate in a striking manner the benefits to be derived from this method of treatment in cases of cardiac, renal, or hepatic dropsy when other less radical measures have failed. Karell published his original work in 1866; and recently Goodman (Archives of Internal Medicine, 1916, xvii, p. 809) has published the results of his experience with the method in over 100 cases. Some of the points emphasized by Goodman as being necessary to the proper use of milk are well worth repetition, as attention to detail is of prime importance.

Choice of Cases.—The method can be used for a variety of conditions, but is especially of value in edema, whether due to cardiac, renal, or hepatic insufficiency. As a means of reducing obesity it also is valuable. A definite contraindication for the use of the Karell method arises when any symptoms of uremic poisoning are noted. In uremia the essential therapeutic consideration is elimination, and the restriction of fluid necessary to the successful employment of the Karell cure may be decidedly harmful to the uremic patient.

Method of Employment.—For reasons perhaps not entirely understood the method, to be successful, must be adhered to

strictly. Milk, 200 c.c., every four hours—8, 12, 4, and 8 o'clock —may turn the trick, whereas the same amount of milk given more frequently in smaller doses may not produce results. It is, of course, true that many patients with edema, perhaps most patients, will react favorably to a less rigid cure. A diet poor in salt, with restricted fluid but containing other foods than milk, frequently will cause marked diuresis, with the loss of edema; but when the patient does not react to such moderate methods and the Karell is finally employed, it should be used in the detailed method outlined. Absolutely no other fluid can be allowed, and Goodman says that "the purpose of the treatment is immediately defeated if the patient is allowed to drink the milk whenever he pleases."

The **effects of the cure** can be seen often in one or two days, but sometimes not for seven or eight days. In my experience the effect has been seen rather early, perhaps due to the fact that I usually try the modified salt-poor, restricted fluid diet before resorting to the Karell. Usually the effect of any diet in conditions involving renal insufficiency cannot be noted immediately, as can easily be proved by following the curve of chlorid or nitrogen excretion in cases of nephritis. Therefore the preliminary preparation makes the soil fertile, and when finally the milk "cure" is given the reaction will be more rapid than in those patients who have been receiving unlimited amounts of salt and water.

Usually the first effect of the cure is a protest by the patient. But, as we have abundantly learned in treating diabetics, even complete starvation will be borne if the patient's confidence is obtained and the promises offered by the method are carefully explained. The thirst of the first day or two soon disappears, and when diuresis starts the patient feels so much better that he is more than willing to continue to the end. In cardiorenal cases, as the floodgates open and the bloated condition fades away into the outlines of normal anatomy, the heart's action improves, the dyspnea disappears, and the transformation from complete invalidism to more or less complete comfort follows.

But again let me emphasize that the patients in whom the

Karell cure is used are damaged goods, and no method of treatment can restore normal function to a heart whose very muscle-fibers are damaged, or to a kidney or liver already marked by permanent pathologic changes. The diet must be properly balanced even after results are obtained from the Karell cure. Almost all such patients have a distinct and definite tolerance for both sodium chlorid and water, a tolerance which must be respected at all times. Therefore, much care is necessary in the gradual addition of food to the diet, and each patient must be individualized. As a guide to treatment I shall show some diet lists arranged purely schematically:

Breakfast.—Stewed fruit, cereal with sugar and a small amount of cream, toast, saltless butter, cup of cocoa or milk.

Dinner.—Potato (mashed or baked), spinach (or other stewed vegetable), small amount of chicken, fish, or well-broiled beef; junket or custard, toast and saltless butter, cup of milk.

Supper.—Cereal with cream and sugar, one egg, creamed celery (or other stewed vegetable), stewed fruit (or baked apple), toast and butter.

(1) Use no salt in cooking.

(2) Add no salt in eating.

(3) Limit *total* fluid intake; 28 ounces (800 c.c.) to 32 ounces (1000 c.c.) are the limits usually advisable.

(4) Foods (also salt and water) are added according to the reaction of the individual patient.

Before closing this discussion I wish to draw attention to the use of drugs in these conditions. You will have noted that in our two patients no drugs were given during the rigid treatment. The patient with myocarditis had been given digitalis preparations to the point of producing toxic symptoms without any noticeable effect on the circulation. Therefore, during the milk cure all drug therapy was suspended, as experience shows how little good arises from drugs during the stage of congestion. Usually the patients on whom the milk cure is used have already been saturated with digitalis or other diuretic drugs, and, as a general rule, it is wise to discontinue all medication (except purgative pills), at least at the beginning of treatment. Judgment

must be used in following this rule, as surely certain patients require the whipping effect of digitalis.

But temporary cessation of drugs during the milk treatment may be followed in a few days by better use of the same drug. For instance, our patient with myocarditis during a recent breakdown exhibited marked gastric disturbances whenever digitalis in any form was given; but after a few days of milk with complete freedom from drugs he was able to take digipuratum without any gastric upset and with a decided influence on his circulatory system. This increased tolerance to digitalis is, I think, one of the most valuable results of the Karell cure.

THE IMPORTANCE OF DETAILS IN THE TREATMENT OF ANGINA PECTORIS

The two patients whom I am going to show illustrate certain points in the treatment of angina which perhaps are apparent to most of you already. However, it seems worth while emphasizing these little things, especially since in these two patients and in others whom I have seen recently lack of attention to these details resulted in many attacks of angina, while as soon as the patient's attention was drawn to them good health resulted.

The first patient is sixty years old and is, as you see, quite a healthy looking man. About a year and a half ago he began to have typical attacks of precordial pain shooting down his left arm into his finger-tips. Up to that time he had been in very good health, was an active business man, and played golf frequently. As far as he knows, the past history has been uneventful except for an attack of typhoid fever as a young man. The attacks of angina were repeated time and time again, and were especially noticeable after meals or after walking. Climbing stairs, interestingly enough, produced no attacks.

His physicians warned him of the dangers of these attacks and, in fact, told him that at any moment he might fall down dead in the street. Under the best medical attention the attacks grew more frequent, so that finally a few months ago when he

came to see me he was having them during the night and when he arose in the morning.

At the time I saw him in October, 1917, the physical examination showed a man in apparently good condition. The eyes had a somewhat haunted expression, as if there were constant fear present. The teeth and tonsils were completely negative, the previous physicians having delved into these carefully. Thyroid was not enlarged, nor was there any general adenopathy. The lungs were normal; the heart was enlarged to the left, extending 15 cm. from the midsternal line. On palpation the apex was somewhat thudding and a systolic thrill was noticeable, especially at the base of the heart. A loud systolic blow was heard all over the heart, more marked at the base and over the aorta. The pulse was regular, slow, of good volume; and the blood-pressure was 145 systolic. The abdominal examination was negative; all the deep reflexes were exaggerated. The urine showed normal amount excreted in twenty-four hours, specific gravity of 1022, a trace of albumin, and a few hyaline and granular casts. The blood examination, including the Wassermann, was completely negative.

The striking feature of this case as it presented itself to me in October was the alarming frequency and the real severity of the attacks. I felt very decidedly that inasmuch as the patient was having his attacks at night and in the morning, even before he got out of bed, and was not having them particularly after exertion, some element in the etiology of the attacks had been overlooked. I told the patient so, and invited his co-operation in discovering what this element might be. After two weeks of observation and frequent conversations with him and his wife, it occurred to me that most of his attacks were produced by psychic stimuli rather than by physical effort. After reaching this conclusion, further analysis of the man's mental condition revealed a status of which even he himself was not aware. He, as well as his previous physicians, thought he was a very brave man who had no fear; as a matter of fact, fear was the dominant characteristic of his whole attitude toward his illness.

It was not the fear of death which disturbed him, but it was

the fear of the pain produced by the attacks. Coupled with this was an intense but repressed desire not to let his wife know how really frightened he was. He was in a state of continual repression. When he went to bed at night he was harassed by the fear of an actual attack and by the fear that his wife might learn of his feelings, and when he awoke in the morning exactly the same condition of affairs was present. He had also had the bad habit of getting out of bed in a hurry, preparing his toilet, eating breakfast and getting off to his office, two blocks away from his residence, without taking the time for any leisurely loafing.

I took great pains to explain to the patient just how attacks of angina are produced, laying especial emphasis on the fact that in many cases just as severe trouble might result from emotional as from physical disturbances. I told him that I was certain that most of his attacks resulted from the tremendous strain under which he was living, and that unless he changed his mental attitude the attacks would increase in frequency and severity. Rather unconsciously we spoke about the influence of the vagus nerve. In reference to the statement about dying in the street, while in no way attempting to minimize the dangers of the disease, I let the patient feel that a proper readjustment of his emotions, a proper and sane view of his own condition would, in all probability, result in lessened attacks. In addition, I urged him to eat his breakfast and read his paper in bed before getting up in the morning. After dressing I ordered him to sit around the house for fifteen to twenty minutes.

All this may sound commonplace to you, but let me assure you that from the standpoint of the patient the results were, to quote the patient, "miraculous." Almost immediately, thanks perhaps to the physical changes in his morning routine, he began to have fewer attacks; and the confidence which the patient obtained from this was followed by an entire change of point of view on his part. He felt that there was some hope, and that if he followed instructions fully he might get along very well. Also he was able, after a little effort, to discuss the whole matter with his wife, and he went to bed at night no longer with the

fear that he might "wake up and find himself dead." Gradually he had fewer and fewer attacks, and at the present time he can go along for days without a single disturbance. Mind you, he passed through the very severe winter which Chicago had, going almost daily the two blocks to his place of business twice a day. When the wind was high and the thermometer low this, we knew, was a precarious thing to do, and it usually caused some distress. The man, however, insisted on the necessity of his attention to business, and on the very bad days conserved his energy by riding in a taxicab.

The most striking feature about this man's case is, I believe, the emotional upset which certainly caused most of the attacks of angina. You will realize that with a heart such as he has at present, readjustment of a man's psychic attitude will not result in a cure, but it will and it did give the man a comfortable existence. From observing the case very closely I am sure and the patient is sure that it was this readjustment of his mental attitude which has changed his life in such a really remarkable way. In making this statement I do not wish to underemphasize the importance of even the small changes we made in his daily routine, but these we will discuss in connection with our second patient.

CASE II.—This patient likewise illustrates how attention to detail in the treatment of angina may change life from a miserable existence of constant pain and worry to one of at least comparative comfort. The patient is a married woman, sixty-five years old, who for many years has been under treatment for "bad heart." I shall not bother you with details of the history which are of no importance from our present point of view, but shall simply give you the essential features of the case.

Last summer she apparently had reached the height of her misery. When I saw her one day in July she was taking as many as fourteen to twenty nitroglycerin tablets a day, on account of the severe attacks of dyspnea and precordial pain, each of which she thought would be her last. Examination then showed the patient somewhat anemic, with a markedly dilated heart and a loud systolic murmur all over. The pulse was rapid but

regular, and the blood-pressure was 170 systolic. The rest of the examination showed nothing of importance. She could not understand why she was having so many attacks of angina, as she was constantly under medical attention and was a very sensible patient, with a full realization of the severity of her condition, but absolutely without any fear of the consequences. She had been sick so long that she no longer anticipated much more from life than a fair amount of comfort—this she was not getting.

The condition of her heart did not offer much hope for any therapeutic effort, but, much to my surprise on questioning her, I found that despite medical care she was neglecting some of the most essential details which might give her relief. For instance, she had been told to rest after each meal, and this she was doing; but before resting she walked from her dining room to her library, a distance of perhaps 75 feet—and immediately she would have an attack of angina. She was having a particularly hard time at night, although she had been following instructions in taking nitroglycerin before retiring. I found that no one had ever suggested to her the use of a back-rest.

Immediately I insisted on two things: First, that she move her Morris-chair into the dining room and take her rest in a semireclining position as soon as she was through eating, and before she took a step except the one that brought her to her chair. The second change I made was to give her a back-rest at night. In this case, as in the first one, a truly remarkable difference was immediately seen. Two days after, when I saw her, she cried with gratitude at the change in her condition. Her nights were peaceful and she passed the day with only two or three very mild attacks. Now, just as with our first patient, it might seem superfluous to call your attention to such simple things as have been enumerated here; and yet, the results more than justify the effort to treat our patients with angina from the standpoint of the ultimate detail.

I do not wish to discuss in full the treatment of this common condition. You all know what the text-books say, and you all know in how many cases excellent results can be obtained. I think it is decidedly wrong ever to adopt an attitude of hopeless-

ness with angina patients. Of course, it is true that any patient who has had angina may drop dead in the street, but it is likewise true that in some patients this knowledge may do more harm than good. Therefore, every effort should be devoted to studying those little details in the patient's life which he has learned by experience will produce attacks. He will at times need your help in ascertaining just what these things are. We should also learn to know what helps the attack in each individual patient. One of my patients got attacks of angina only on those days on which he went to business on the elevated railroad, but as his attacks did not always immediately follow climbing the stairs, he did not realize that the attacks were produced by the extra exertion. When his attention was called to this, he rode to business in his car, and no longer had attacks of angina. One patient had his attacks only during the winter, and he had them even if he stayed at home. A change of climate during the winter months resulted in complete freedom. One doctor found that while nitroglycerin did not relieve his attacks, atropin sulphate in doses of $\frac{1}{60}$ grain had an immediate effect. Many patients will tell you that even when they eat light meals they have attacks of angina, and you can usually find that the cause of these attacks is one of two things, either the patient exerts himself even slightly after his meal, or he is eating something which produces gas in his stomach and presses on his heart. It is not always easy for you to realize how important these little details are; therefore, the patients themselves frequently fail to find the immediate cause of the attacks. The postprandial rest which is so necessary in almost all cases is frequently indulged in only after some physical exercise, which, although apparently negligible, is enough to cause angina.

In conclusion I wish to emphasize again that I have made no effort to discuss in detail the treatment of angina, but I have merely attempted to bring to your attention the importance of going into details in eliciting the patient's story. By careful observation and individualization much misery can be prevented from entering the lives of these patients, over whom always hangs the shadow of the dark valley.

CLINIC OF DR. CHARLES A. ELLIOTT

WESLEY MEMORIAL HOSPITAL

RADIUM TREATMENT OF LEUKEMIA; ONE CASE WITH SPLENECTOMY

RADIUM in the treatment of leukemia appears to have many advantages over either benzol or the *x*-rays. Benzol has been largely discarded as a method of treatment of leukemia on account of its extremely toxic action, not only on the hemopoietic system but also on the tissues generally, notably the heart muscle. Its action is uncertain and limited and is not followed by the beneficial results noted in either *x*-ray or radium therapy. The reports of the results of *x*-ray treatment for leukemia have been so conflicting that one must conclude that its efficiency depends largely upon the man who applies it. Some roentgenologists report remarkable results and are able to control certain cases for indefinite periods. One patient under observation in this clinic with well-developed splenomedullary leukemia, a woman now eighty-eight years of age, has been apparently well controlled for four years in the hands of a colleague who applied the *x*-ray therapy. This patient continues in good health, the spleen has receded to the rib edge, and the white blood-cells have dropped from 163,200 to between 22,000 and 37,000, but myelocytes are always to be found, averaging from 3 to 11 per cent. The *x*-ray treatment for leukemia leaves much to be desired. Even in the best of hands these controlled cases are still to be recognized as cases of leukemia. The splenic tumor rarely completely disappears and the blood examination always reveals a pathologic condition.

The radium treatment of leukemia offers several advantages over that of the *x*-ray. It is more readily applied, is more decisive in its action, the effects are more lasting, and treatment is necessary only at long intervals.

Technic of Applying Radium in These Cases.—The technic here employed is simple: 100 mg. of radium element in 25 mg. tubes, screened in lead, and raised about ¼ inch from the skin by a layer of gauze may be applied with adhesive tape about the circumference of the spleen. The tubes are left in one position from four to six hours, not longer, and at the end of that time they are shifted to a new position about the circumference of the spleen, where they are left for an additional four to six hours. The application of the radium was not continued longer than eight to twelve hours (in two positions of four to six hours each) upon any one day. On the second and third applications, on succeeding days, the tubes are distributed about smaller circles within the circumference, shifting their positions at the end of from four to six hours, as heretofore. The total amount of radium thus applied in three successive days may be 2400 to 3600 mg.-hours. This course of treatment may then be repeated at the end of thirty days, and at the end of sixty days the splenic tumor may be so small that but one such daily treatment of 800 mg.-hours may be made.

In the three patients here presented there have been remarkably good results following radium treatment. After a very few treatments and in a remarkably short period of time the blood-picture has returned to almost normal, the splenic and glandular tumors and liver have receded, and the patients have apparently regained their usual health.

Splenectomy as a cure for myelogenous leukemia was repeatedly resorted to from 1866 (Bryant, Guy's Hospital Reports, 1866, xii, p. 444) to 1890, but with little or no success on account of the great operative difficulties encountered in removing the enormous splenic tumors. A rather careful search of the early literature reveals but one case which is said to have recovered from the operation.

Splenectomy following radium treatment, the spleen being small, may be resorted to without encountering great operative difficulty or undue operative risk, and may be of real benefit in a certain class of cases. The fact that radium applied over the splenic area has such a remarkable result upon the general blood-

picture lends support to the idea that the spleen may play more than a passive rôle in the etiology of splenomedullary leukemia, and the results of its removal after radium treatment will be watched with great interest.

The removal of the spleen in experimental animals causes the white blood count to persist at a slightly higher level than normal, and this effect of splenectomy is to be reckoned with in cases of leukemia treated by splenectomy. The enormous splenic tumor of myelogenous leukemia on account of its size alone is a source of much disability, and splenectomy following radium treatment may be logically resorted to for the elimination of the mass regardless of the beneficial effect splenectomy may have upon the leukemia and without unduly jeopardizing the life of the patient. Such a case is the first here presented.

CASE I. MYELOGENOUS LEUKEMIA WITH RADIUM TREATMENT FOLLOWED BY SPLENECTOMY

Mrs. E. H. O., thirty-five years, housewife, American.

Family History.—Father died at fifty-nine of cancer of the bladder. Mother and two sisters living and well. Husband and three children living and well. No history of tuberculosis in family.

Past Illness.—Measles, scarlet fever, pertussis, varicella, diphtheria when a child. In July, 1914, she was very ill with a supposed stone of the left kidney. Attack subsided without operation. In September, 1916, she was jaundiced, had gastric distress, vomited. Jaundice disappeared without incident after four weeks. Has had frequent attacks of bronchitis.

Present Complaint.—1. Splenic tumor with pain and tenderness in that region.

2. Marked dyspnea and general weakness.
3. Loss of weight 20 pounds from June to September, 1916.
4. Nodules in the subcutaneous tissues.
5. Tingling sensations in arms.
6. Frequent attacks of jaundice with nausea and vomiting.
7. Gastric indigestion, belching, constipation.
8. Frequent urination, especially nocturia.

In June, 1916, patient noticed a mass in the left upper quadrant of the abdomen which was somewhat tender to pressure. This rapidly increased in size until September, 1916, since which time it has remained about the same size, filling the left abdomen and extending to the symphysis pubis. With the increase in the size of the tumor the patient lost weight, strength, and became extremely dyspneic on exertion, and gastric phenomena, such as belching, indigestion, and feeling of fulness after even light meals, developed. Previous to the onset of the present trouble patient had never had headaches, but since June, 1916, she has had frequent and severe headaches, mostly frontal in type, and frequently associated with nausea and vomiting. She dreaded eating on account of distress following. She complains of the heaviness and pressure of the tumor mass. Menstruation was previously normal, but after the onset of the present trouble it has been irregular.

Physical Examination.—Patient is a poorly nourished, emaciated woman of thirty-five years. Skin is rather dark, but no marked areas of pigmentation are present. There are many small tumor masses, apparently leukemic infiltrations of the skin, scattered over the body. Some of these are stated by the patient to be of only forty-eight hours' duration. A number of them are surrounded by hemorrhagic areas. These average the size of a silver dollar. The scleræ show definite icterus and anemia. Tonsils are small. Teeth show several extensive carious teeth, but no evidence of abscesses. Pharynx is granular; otherwise negative. Small glands, split-pea sized, are everywhere just palpable in clusters. Bones show no points of tenderness. Diaphragm is normal, left stands higher than the right, excursion of three fingers. Lungs are resonant throughout, with no abnormal sounds except posteriorly the breath sounds are prolonged over both apices. Capillary circulation is good. The radial pulse is quick and somewhat irregular. The heart area is normal and there is a systolic murmur at the apex, the second pulmonic tone is accentuated; otherwise negative. The abdomen shows a large splenic tumor, the surface is irregular, three distinct notches are palpable at the edge, there is no friction-rub. The liver

appears enlarged, stands from one fingerbreadth below the nipple to the level of the navel, edge is sharp and tender. Surface is smooth except for one area the size of a dollar in the midclavicular line, which extends as a plateau above the level of the rest of the liver. Reflexes are normal throughout, pupils react to light and accommodation. Pelvic examination gives negative findings except for a relaxed perineum, and the uterus appears to be forced into the culdesac by the presence of the splenic tumor. Adnexa are not palpable. The spleen is palpable vaginally.

Blood-pressure is 102 systolic and 64 diastolic; weight 100¾ pounds; urinalysis shows a trace of albumin, no sugar, casts, nor red cells, and an occasional white cell. Blood examination shows 3,648,000 red cells, some poikilocytes, few megalocytes, few microcytes, few normoblasts, megaloblasts, and microblasts being found. White cells 311,200, of which the differential count is as follows: lymphocytes 8 per cent., large mononuclears 10 per cent., polymorphonuclear neutrophils 40 per cent., polymorphonuclear eosinophils 4 per cent., polymorphonuclear basophils 6 per cent., neutrophilic myelocytes 22 per cent., basophilic myelocytes 10 per cent. Hemoglobin 75 per cent. (Dare). She runs an afternoon temperature as high as 100.8° F. Pulse throughout the course averaged above 100. Respiration rate averaged 22.

Upon June 19th, 20th, and 21st, 1917, a total of 2400 mg.-hours of radium element, supplied by the Physician's Radium Institute of Chicago, was applied over the spleen. On the third day the patient had experienced considerable relief from pressure. The spleen was evidently considerably smaller, apparently most of the decrease in size taking place in the anteroposterior diameter, as the mass was much more freely movable. The white blood count dropped from 311,200 to 208,000.

July 13, 1917: After leaving the hospital the patient experienced marked relief, especially in the matter of breathing, and there is now no pain or discomfort after eating. Spleen is definitely smaller. It is more movable and thinner. The hand can be inserted behind the spleen, the abdominal walls being relaxed. There is marked discoloration over the splenic area, but

the skin shows no other evidence of radium burns. The blood-picture has changed, the leukocyte count is less, there are more nucleated reds. There are numerous subcutaneous leukemic nodules on the right thigh and about both knees. There are a few subcutaneous hemorrhages the size of a quarter of a dollar on the left leg.

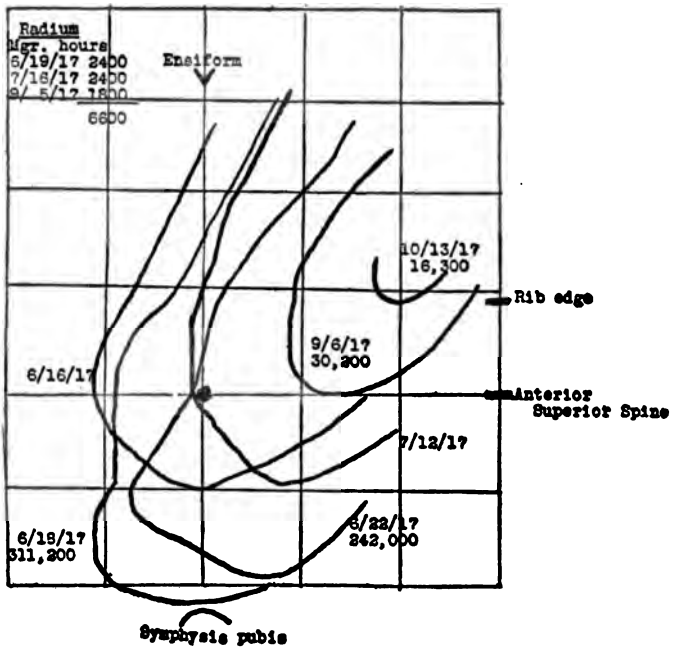

Fig. 211.—Case I. Spleen outlined on abdominal wall according to scale. Note the rapid diminuition in the size of spleen coincident with the reduction in the white blood count following the application of 6600 milligram-hours of radium element.

On July 13th, 14th, and 15th, 1917, the patient again received a total of 2400 mg.-hours of radium element. A total of 4800 mg.-hours so far applied.

July 16, 1917: There has been a decided reduction in the size of the spleen, the liver is still large and tender. Patient sleeps well and feels generally well. White blood count 150,200.

July 21, 1917: Patient woke this morning with a headache,

temperature 103° F., pulse 104, white-cell count 19,000, red cells 3,190,000, hemoglobin 60 per cent. The spleen is much smaller. There is swelling in the right parotid region.

August 4, 1917: Patient has had an acute attack of mumps which was then epidemic in her family, first the right parotid and then the left was involved. She has been extremely ill from this attack. During this time the spleen has become much smaller in size, extending 1 inch below the navel and to the midline. The liver area is still broad, three fingers below the rib edge, and is tender. White cell count 15,950; red cells 3,440,000; hemogobin 69 per cent.; weight 105 pounds. Urine is normal. There are three superficial radium burns over the splenic area.

September 1, 1917: White cell count 19,950; red cells 3,920,000; hemoglobin 67 per cent.; differential count shows lymphocytes 13 per cent., polymorphonuclears 80 per cent., myelocytes 7 per cent. Spleen is much smaller, extends about three finger-breadths below the rib edge, and is 20 cm. from the diaphragm to the tip.

On September 5th, 6th, and 7th, 1917, 100 mg. of radium element were applied over the spleen for three six-hour periods. A total of 6500 mg.-hours have been applied.

October 13, 1917: Weight 128¼ pounds; white cell count 16,300, polymorphonuclear neutrophils 80 per cent., myelocytes 1 per cent., large mononuclears 9 per cent., basophils 2 per cent., occasional nucleated red, hemoglobin 84 per cent.; red cells 3,650,000. Spleen is 2 cm. below the rib edge, 14 cm. from diaphragm to edge of spleen, not tender, firm, movable. One leukemic nodule persists on the left shoulder about the size of a dollar.

November 16, 1917: Weight 134¼ pounds, spleen appears larger, is 15 cm. from the diaphragm to edge. The edge is 4 cm. below the costal arch. White cell count 26,800; red cells 3,820,000; hemoglobin 85 per cent. An alveolar abscess has developed over the upper first molar tooth. Radiographs of this tooth show a large abscess and the tooth was ordered removed.

December 15, 1917: There is a superficial radium burn under the left breast. Patient feels well and in her usual health

otherwise. Weight 139½ pounds, a gain of 39¼ pounds since beginning radium treatment.

December 29, 1917: On account of the apparent tendency of the spleen to enlarge and in view of the uncertainty of the results of treatment, it was decided to remove the spleen, as the immense

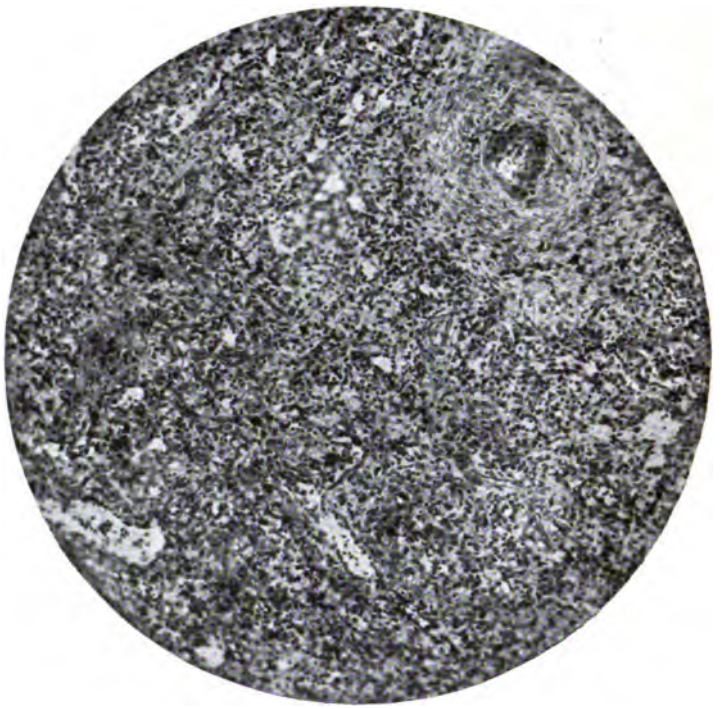

Fig. 212.—Case I. Section of spleen after treatment with radium (6600 milligram-hours). Note diffuse increase of connective tissue. There is considerable deposit of pigment throughout. There is no myelocytic infiltration recognizable as typically seen in myelogenous leukemia. (Magnification 120 diameters.)

tumor mass had been previously a source of great distress. This was done without incident by Dr. H. M. Richter.

At operation the spleen was found to be free from adhesions, the peritoneal reflections were readily peeled off, and the whole spleen was delivered through the incision and removed without difficulty. The vessels were found to be unusually large, the

liver was small, surface smooth, no adhesions. Gall-bladder was filled with small stones. No accessory spleens were found.

Examination of the Spleen.—Weight 300 gm., 11½ x 8 x 4 cm.; firm in consistency; surface is smooth; capsule glistening—not rough. A number of fine yellowish areas can be seen through the capsule. The cut surface is remarkably dry, but not otherwise unusual, no leukemic nodules are apparent.

January 14, 1918: Patient discharged from the hospital in good condition, there having been no untoward effects due to the operation. White cell count 11,700.

February 15, 1918: Weight 136 pounds. Patient feels as well as she ever did. Her only complaint is that of persistent itching at the site of the radium burns, which have healed, but are scaly. The leukemic tumor on the left shoulder persists the same as before. Red cell count 3,870,000; white cells 25,100; hemoglobin 70 per cent.; polymorphonuclears 77 per cent.; large mononuclears 6 per cent.; basophilic myelocytes 1 per cent.; basophilic polymorphonuclears 4 per cent.; lymphocytes 6 per cent.; myelocytes 5 per cent.; Turk irritation lymphocyte 1 per cent.

Comment.—The results of radium treatment in this case are remarkable. What effect the mumps in severe form, contracted during the course of the treatment, had upon the course of the leukemia is a question. The white blood count dropped suddenly at that time. There were no difficulties encountered in removing the spleen. The patient's health at the time of writing (March 14, 1918) is excellent. She has gained 35¾ pounds in weight. The blood-picture appears normal, the increased leukocyte count of 25,000 being interpreted normal following splenectomy, reasoning from experimental results on animals. The effect of the radium treatment upon the microscopic appearance of the spleen later removed are such that the tissue would hardly be recognized as that of a leukemic spleen.

CASE II. MYELOGENOUS LEUKEMIA WITH RADIUM TREATMENT

Mr. C. S., forty-six years, carpenter, Danish.

Family History.—Parents lived to advanced age. Five children living and well. Four children died—three stillborn, one in infancy.

Habits.—Drinks occasional beer, moderate user of tobacco, otherwise negative.

Previous Illness.—Typhoid at sixteen, severe course without complications, otherwise always well except for occasional attacks of migraine since childhood.

Present Complaint.—1. Large splenic tumor filling the left abdomen.

2. Dyspnea and general weakness.

3. Loss of weight.

4. Advancing anemia.

5. Polyuria and nocturia.

In the spring of 1915 the patient first noticed dyspnea and advancing weakness, but he continued to work. In July, 1916, he noticed that he had become pale and there was an increase in the dyspnea to such an extent that he could not walk up a flight of stairs. In December he by chance noticed the tumor mass in the left abdomen, and he believes that it has not grown in size nor changed in consistency since first observed. Polyuria has been present for five months; he awakens from three to four times at night to urinate, but has had no other distress. He has never had hemorrhages of any sort, no tenderness over the bones. The loss in weight has been but slight.

He is thin, anemic, no edema or jaundice. He appears to be a well-developed man, tonsils are moderately enlarged, just visible between the pillars. The heart area is 10 cm. in transverse diameter. There is a systolic murmur at the apex and base. Precordial pulsation is prominent. Lungs are negative. The abdomen shows a massive splenic tumor 1 inch to the right of the navel and 1 inch below the level of the anterior superior spines. Surface is smooth, painless. There is no friction-rub to be heard. The liver is enlarged, with the lower border

1 inch below the navel. Abdomen otherwise negative. Reflexes are normal.

On May 25th patient developed an attack of renal calculus with intense pain, vomiting, and on the second day thereafter passed a small renal stone, with relief of symptoms.

Radium was applied irregularly by Dr. Frank Simpson from May 26th to June 30th, a total of 6600 mg.-hours, the amounts

Fig. 213.—Case II. Photograph of case of myelogenous leukemia, May 29, 1917, at beginning of radium treatment. Note emaciation. Spleen occupies whole of left abdomen. White blood count 294,000.

Fig. 214.—Case II. Photograph of same case, March 11, 1918, eight months following last radium treatment. Note absence of cachectic appearance, increase in weight, healed scars of radium burns. Spleen not palpable, white blood count 11,200, no pathologic cells.

and duration of applications varying. During his stay in the hospital there was a marked reduction in the size of the spleen, and upon discharge July 3, 1917, it extended to 1 inch below the navel and 1½ inches to the left of the midline. White cell count was reduced from 294,000 to 33,000. He looks and feels well.

September 5, 1917: Patient's general condition is excellent, the spleen is not palpable. White cell count 6000, no pathologic cells found.

December 18, 1917: White cell count 11,000; red cells 4,010,000; hemoglobin 95 per cent. Patient seems in good health and strength, looks well, and has gained 35 pounds. Spleen is just palpable, extends 1 inch below the edge of the rib on deep inspiration, is not tender. Teeth show some pus pockets, and he was referred to the oral surgeon for treatment.

February 8, 1918: Patient is in good health, feels better than he has for several years. Spleen is not palpable except on deep inspiration. Weight, 164 pounds.

March 11, 1918: Patient is apparently in good health. Spleen is not palpable. The healed scars from radium burns cause no discomfort. Red blood count 5,640,000, no nucleated reds, the stained specimen shows no pathologic cells; white blood count 11,200; differential count: lymphocytes 14 per cent., large mononuclears 3 per cent., polymorphonuclear neutrophils 80 per cent., polymorphonuclear eosinophils 1 per cent., polymorphonuclear basophils 2 per cent., hemoglobin 90 per cent. (Dare).

Comment.—The effect of radium treatment in this case leaves nothing to be desired at this writing (March 14, 1918), eight months following completion of the radium treatment. The patient appears well, has gained in weight, the spleen is not palpable, and the blood count is normal.

CASE III. LYMPHATIC LEUKEMIA WITH RADIUM TREATMENT

Mr. P. D. C., fifty-five years, salesman.

Family History.—Negative.

Previous Illness.—Typhoid at forty, diagnosis in doubt. Herniotomy two years ago.

Present Complaint.—The patient had undergone two courses of treatment (August, 1916, and October, 1916) with benzol together with *x*-ray, for lymphatic leukemia, the exact amounts of benzol and *x*-ray treatments are not known. There was little if any improvement as far as his general condition was concerned,

although the white blood count is reported to have dropped from 264,800 cells, of which 98 per cent. were lymphocytes, to 40,800 cells, of which 94 per cent. were lymphocytes. At that time, he states, he had swelling in the cervical regions, axillæ, and groins. His illness had begun two years before that time, *i. e.*, in 1914. He first noticed swellings in the submaxillary region after a "cold," the symptoms of which were a rhinitis and pain in the head. These symptoms and the swellings disappeared without treatment, and remained apparently absent for about six months. Then the submaxillary swellings reappeared and tumor masses appeared in the cervical regions and groins. Patient felt well at the time of admission and has been apparently so throughout the period in spite of the swellings in the regions mentioned. There has been no other complaint.

Physical Examination.—He is a tall, rather thin, anemic individual, with marked tumor masses protruding from the cervical regions, axillæ, and groins. The spleen is somewhat enlarged and is readily palpable. The liver is apparently somewhat enlarged, the edge being palpable on deep inspiration. Retroperitoneal glandular masses are palpable in the lower abdomen. Cardiovascular conditions are normal, heart tones are normal, no murmurs.

January 11, 1917: Radium treatment begun by Dr. Frank Simpson. The radium was given at irregular intervals and in irregular amounts. White blood count was 113,000. The applications were followed by pain in the region and a definite redness surrounding the tumors.

January 30, 1917: He has had fifteen applications of radium in small amounts applied to the glands, with one application over the spleen. There has been a remarkable solution of the tumors. The masses are very soft, pliable, and painless. There has been some soreness and redness following each treatment. The masses in the axillæ are like soft, mushy bags. Spleen is palpable.

February 6, 1917: Patient has had seventeen applications of radium in varying amounts, there being a total of 6600 mg.-hours. There has been a marked reduction in the size of the tumor masses. White count is now 5400, no pathologic cells.

There have been a number of superficial burns over the sites of the tumor masses, especially in the groin, which heal slowly.

May 23, 1917: Except for the radium burns the patient seems very well. He appears anemic. The spleen is just palpable, extending down 1 inch below edge of ribs on deep inspiration. The abdominal glands can be felt on deep palpation, but they feel soft and mushy, the same as the glands in the neck. Blood-picture would not be recognized as one of leukemia. White cell count 11,000.

Fig. 215.—Case III. Photograph of case of lymphatic leukemia, January 10, 1917, before beginning radium treatment. Note glandular tumors in cervical and axillary regions. White blood count 113,000.

Fig. 216.—February 2, 1917. After three weeks of radium treatment, 6600 milligram-hours in all. Note diminution in size of tumors and improved general condition. White blood count 5400.

This patient left our observation for a visit in California and has not returned. The immediate results of the radium treatment were remarkable for the rapidity with which the masses were reduced in size and the blood count came down to normal. When last seen he was in good health, but we have not heard from him recently, and cannot now speak of the ultimate results of the radium treatment in this case.

General Conclusions.—1. The effect of radium radiation in

the treatment of these 3 cases of leukemia was remarkable, and appeared to be much more effective and certain than other methods of treatment heretofore employed in this clinic.

2. The white blood-cells have rapidly returned to within normal range, and pathologic white cells have largely disappeared from the stained smear.

3. There has been a decided increase in the number of red blood-cells and hemoglobin.

4. The spleen and lymph-glands have rapidly decreased in size, and the microscopic appearance of the one spleen removed following radium treatment shows no leukemic infiltration, as is usually seen in such spleens.

5. The weight, general health, and general well-being of the patients have all improved to a remarkable degree.

CLINIC OF DR. FREDERICK TICE

COOK COUNTY HOSPITAL

EPIDEMIC RESPIRATORY INFECTION

February, 1918.

IT would seem apparent that even the casual observer must have been impressed with the prevalence of respiratory infections during the past few months.

When considered numerically and geographically it would appear justifiable to conclude that some epidemic type of infection is not only frequent but widely distributed. Perhaps the most forcible clinical observation is the extreme bizarre manifestations and clinical course. While a fair proportion begin with symptoms and signs of an ordinary coryza, not a few are initiated with a severe chill, high fever, pains or aches, and other complaints. Physical examination at this time frequently reveals only the findings of an infection of the upper respiratory passage. In some instances, within a few hours or days, the findings develop into a more or less definite clinical picture of some particular type, but frequenty the course and findings remain so obscure that a diagnosis is impossible. During this time not only the patient but the medical attendant must experience much anxiety and perhaps misgivings.

In reviewing the cases under observation, many of them presented in this clinic during the past year, it is easily possible to divide them into two groups:

1. Including those where the infection occurred as a primary clinical entity, followed subsequently by recognizable findings or complications.

2. Those in which the infection accompanied or followed some previous infection, resulting in a recurrence or variation of the previously existing disease.

Before considering these groups in detail it will be of service to indicate the bacteriologic findings as revealed in some of the investigations in the present epidemic.

Most investigators have found a mixed type of infection, including chiefly the influenza bacillus, streptococcus, pneumococcus, Micrococcus catarrhalis, and less frequently other organisms.

With the general unanimity of findings as to the mixed type of infection, there exists a most divergent opinion as to the predominant and exciting organism, and what relation, if any, it bears to the present epidemic. Perhaps this difference of opinion may be accounted for on the variability of the type of infection or organism as observed in different localities under varying conditions.

According to some of the published reports the chief offender is a streptococcus; others have found some type of the pneumococcus, while others would incriminate the influenza bacillus.

Brief reference may be made to some of these findings. Moody, Mathers, and others have investigated the epidemic of respiratory infections in this locality. Moody, by throat cultures on blood-agar in 31 cases, found the Streptococcus viridans, pneumococcus, and a hemolytic streptococcus present in all cases. In only 2 was the influenza bacillus present. Mathers investigated 24 cases by similar methods. The Streptococcus viridans and pneumococcus were present in all; a hemolytic streptococcus in 17, and failed in all to obtain the influenza bacillus.

Williams and Burdick, in Denver, report finding a hemolytic streptococcus and succeeded only twice in over 500 sputum examinations to grow the influenza bacillus.

Ceconi, in the Boston Health Department, considers the influenza bacillus as the chief and determining organism in the recent epidemic. Many similar reports might be cited.

The two organisms most frequently found are the streptococcus and pneumococcus. Serious doubt exists as to the

etiologic significance of the influenza bacillus. Apparently it pays but a minor rôle in the present epidemic.

Clinically considered, the group of primary infections presents many points of interest and not a few problems. As in previous epidemics, pulmonary and cardiac involvement have predominated, but apparently no part of the body is immune.

Infection of the upper respiratory tract is the general rule, with a gradual descending course. Laryngitis, bronchitis, and a bronchopneumonia are frequent, while myocardial or endocardial involvement are by no means infrequent. Accessory sinus infection, otitis media, and mastoiditis have received their proportion, which may also be said of arthritis, renal and neuromuscular manifestations. Meningeal involvement has been relatively frequent. During the past week 2 such cases went to autopsy, with the anatomic findings of streptococcal cerebrospinal meningitis.

Some of the pulmonary disturbances deserve special mention. Particularly frequent and certainly persistent and annoying is a type of bronchial asthma. Following the usual manifestations a subacute or chronic bronchitis develops into attacks of typical bronchial asthma in individuals previously free from such disturbance. The frequency of such occurrence is such that it is impossible to consider it merely as a coincidence, but forces the conclusion of a definite etiologic relationship. These cases therapeutically are hardly short of exasperating.

Instead of the manifestations assuming an asthmatic type, the infection persists and simulates a pulmonary tuberculosis. In not a few there is a cough, perhaps paroxysmal, with blood-tinged sputum, slight afternoon temperature, loss in weight and strength, with night-sweats. These symptoms combined with the physical signs of a bronchitis must arouse the suspicion of a pulmonary tuberculosis and may tax to the extreme the differential diagnostic resources. Continued, repeated, and persistent clinical observation over some period of time may finally succeed in at least an accurate clinical conclusion. Along with the bronchopneumonias is to be mentioned lobar pneumonia, and especially the atypical forms as regards physical findings and lung

location, as well as the evident marked tendency to lung abscess, gangrene, and empyema.

Lung abscess and gangrene have occurred with surprising frequency. The marked tendency to asthmatic manifestations, and in others to develop lung abscess or gangrene, has been so evident as to constitute a rather striking feature of the infection. During the past few months 7 cases of lung abscess, 2 associated with empyema, have been observed. Evidently there is a common basis or cause for the bronchial and pulmonary complications, either some peculiarity of the type of infection or the resulting tissue changes produced by the infection.

As in the previous epidemics, in some of the cases the chief complaints have been abdominal. Not only gastro-intestinal but quite circumscribed and limited to some particular region, suggestive of pelvic, appendical, or peritoneal involvement. A limited number have presented a clinical picture with either splenic or hepatic findings. In three instances the spleen was enormously enlarged, with slight enlargement of the liver and with a secondary anemia.

In one of the cases a splenectomy was done and a hemolytic streptococcus isolated from the spleen tissue. The remaining two refused operation or even blood transfusion; one of which terminated in recovery, the other was fatal. Autopsy could not be obtained.

One instance of hepatic involvement is under observation and will be presented.

Present History.—Female, age thirty years, entered the hospital December 16th with the following history: Seven weeks ago she had a severe cold and sore throat which persisted for about one week. Six weeks ago, one week after the onset, she had abdominal pain and cramps, followed by nausea and vomiting, which recurred during a period of about one week. During this time a marked lumbar stiffness and lameness developed. Then followed a week of improvement, with a second attack of nausea, vomiting and pain, which continued only a few days.

One week ago she had sharp pain in the hepatic region. Pain was severe, increased by moving, deep breathing, and cough-

ing. No nausea, vomiting, or jaundice was present. During the past four days she has been confined to bed on account of the pain in the right side and cramps in the abdomen. With the exception of the usual diseases of childhood she has always been well.

Physical Findings.—Examination revealed the signs of an enlarged, tender liver without jaundice. Hepatic dulness anteriorly extended upward to the third rib, posteriorly to lower angle of the scapula. Lower border of the liver, in the nipple line, was midway between the costal arch and umbilicus. The liver surface and border was smooth but very tender, especially in the gall-bladder region. The splenic dulness increased, but palpation was questionable, owing to tenderness. Traube's space was practically absent. No ascites or distended veins were present. The apex of the heart was in the fourth space and in the nipple line; no murmurs present. During the first two weeks in the hospital temperature in the morning was normal; in the afternoon it would reach 101° or 102° F. Pulse was between 108 and 116, with respirations 22 to 28 per minute. The temperature during the third week was practically normal, at the end of which it again increased, reaching 101° F. in the afternoon for four days, since which time it has been normal. Remaining physical findings were normal.

Laboratory Findings.—Blood examination: Hg., 88 per cent.; reds, 5,420,000; whites, 17,600 on admission and 15,400 one week later. The blood Wassermann was negative. The urinalysis was negative except for slight albuminuria. Repeated gastric and stool examinations were also negative.

x-Ray Report.—Screen findings: Right costophrenic angle cloudy, left costophrenic angle clear. Both apices light up well. Plate: The right diaphragm is unusually high, such as is seen in subphrenic conditions, such as abscess, large liver, etc.

Exploratory puncture in the postaxillary line, eighth and ninth interspaces, was negative.

A clinical diagnosis of an acute infective hepatitis, and possible cholecystitis, was made after excluding, so far as possible, thoracic, subdiaphragmatic, and other hepatic or abdominal disease associated with the symptoms and signs as presented.

Treatment consisted of an antiseptic gargle and internally acetyl salicylic acid (gr. x) t. i. d. during the period of pyrexia.

At the present time she is free from symptoms, the liver has gradually decreased in size to practically normal.

Previous or accompanying disease with associated epidemic infection has constituted a fair proportion of the cases. This is particularly true of the recurring chronic bronchitis and asthma in which acute exacerbations or attacks follow the infection.

Two other pulmonary diseases, tuberculosis and pneumonia, apparently are much influenced by this complicating infection. It would appear reasonable, in the presence of an epidemic, to assign to it the definite atypical course as observed in these diseases. It is even possible that many of the recently detected cases of pulmonary tuberculosis are due to the activating influence of the secondary infection. Many such cases might be cited. In one at least the respiratory infection was promptly followed by an acute pulmonary miliary tuberculosis in an individual of fifty-four years of age whose previous health had always been perfect. Not only the irregular and atypical forms of pneumonia but also the high mortality may be due to the same cause.

The findings in a recent clinical study will be of interest in this connection. During the four-month period from December 1, 1915, to April 1, 1916, there were 501 cases of lobar pneumonia admitted to this hospital, of which 201 died, or a mortality of 40 per cent. In conclusion:

1. Until further bacteriologic investigation it will be impossible to assign any one specific organism as the microbic cause of the recent and still existing epidemic.

2. The preponderance of evidence is definitely opposed to the influenza bacillus as an active factor.

3. If it be admitted that influenza, or la grippe, is due to a specific organism, the bacillus of Pfeiffer, it will be impossible to designate the present epidemic by such terms. It will be necessary to employ such terms as "epidemic respiratory infection" or, perhaps better, to limit the names now in common use—grippe and la grippe—to the mixed type of infection to the exclusion of the specific bacillus.

4. The relative frequency of asthma, pulmonary abscess with cavity formation, and irregular types of pneumonia with complications suggests some definite common pathologic cause. Until further investigation the work of Jobling and Peterson is not only worthy of serious consideration, but may be accepted as a working basis.

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CLINIC OF DR. CHARLES SPENCER WILLIAMSON

COOK COUNTY HOSPITAL

PRESENTATION OF A CASE OF POLYCYTHEMIA—VAQUEZ'S DISEASE

THE case today is a patient in whom I am very much interrested. Before he came into the hospital I was called in consultation on the case, and when he came into the hospital he happened to be placed on my service. He came here for some *x*-ray treatments. He is a man of intelligence, a painter by trade, native of America. He entered the hospital with the examining-room diagnosis of "myelogenous leukemia." His trouble had been diagnosed previously as pernicious anemia, but neither of these is correct. He came in complaining of three things: First, a swelling in the left side of the abdomen; second, weakness; third, shortness of breath, coupled with pain on the left side of the abdomen.

Onset and Course.—He commenced to have pain a year ago in the upper part of the left side of the abdomen. The abdomen was increasing in size. The pain was dull in character, as a rule, but was sometimes sharp, and was made worse by walking or trying to work. He had these attacks of pain, but paid no attention to them until about eight weeks ago, when they became much worse and he went to a private hospital. At this time he was told that he had a large spleen which should be treated. He then went to another hospital for *x*-ray treatments. He had six of these, the last a week ago. These treatments were superficial because they did not have an apparatus adequate for deep treatments. None of the symptoms which he presents at present bear any relation to the *x*-ray treatments.

He worked up to eight weeks ago. He thinks the tumor in the left side has grown larger within the last eight weeks. The

weakness was gradual in onset; it was not very marked until three or four months ago, but since that time has been very marked. Shortness of breath has been present for many months, steadily getting worse. He thinks he has lost about 10 pounds in weight in the last two months. The only other thing that he complains of is that he is subject to frequent sore throat.

Family History.—The patient is single; his father and mother are dead, cause unknown. He has one brother and two sisters living and well. There is no history of carcinoma or tuberculosis, and no history of any condition similar to this.

Previous Illnesses.—Has had frequent attacks of tonsillitis and something which was diagnosed as "grip" three years ago. He denies venereal diseases of all sorts.

Habits.—He has taken no alcohol in the last year, smokes and chews moderately. His appetite is good. Bowels regular, urination normal.

Examination.—As we look at the patient we see that he is rather thin, sparely built, with long fingers, and we are at once struck by the peculiar color. It is a little difficult to define, but when we look at the face we see that it is rather a curious shade of bluish red. The lips are distinctly cyanotic, the ears are bluish red, the arms the color of raw beef. In striking contrast to this is the hand, which is rather pallid, with just a tinge of red color about it; the finger-nails, however, show a moderate degree of cyanosis, although not of very high grade. The prominence of the cheeks and the top of the nose show this color very well marked. On the neck we see curious mottlings. The lower extremities show about the same findings.

The Head.—The scalp is negative; the ears and nose are negative except for the color. The pupils are equal, regular, react promptly to light and accommodation. Examination of the mouth shows the teeth to be in only fair condition. Inasmush as he has been a painter we have examined carefully for lead intoxication, but no lead-line can be seen. The tongue is somewhat coated on the dorsum. On the under surface is a very dark, cyanotic color which is quite striking. There is a little elevation on the dorsum of the tongue, which is a scar, the

result of an accident when he was a child. The rest of the mucous membranes are perhaps a trifle darker than normal, but not markedly so. The neck shows no rigidity and no abnormal pulsations of any kind.

The Chest.—It is poorly developed, rather emaciated, expansion is fair and equal on both sides.

The Lungs.—The borders are normal; they move with perfect freedom. There is no impaired resonance and no râles are present.

The Heart.—The apex-beat is not to be felt accurately, but there is a pulsation of diffuse nature which seems to be the apex-beat, closer to the median line than usual and behind the sixth rib. The absolute flatness is at the lower margin of the fifth rib, extends two fingers to the left of the middle line and to the middle line on the right. The relative dulness is a fingerbreadth to the right of the sternum, three fingers to the left of the sternum and the lower edge of the third rib. The heart sounds are clear. There is no accentuation of either the aortic or pulmonic tone and no murmurs are present.

The Abdomen.—Inspection reveals a brownish discoloration on the left side of the abdomen due to a superficial *x*-ray burn. The next thing which strikes us is that the left upper quadrant is very protuberant, and that he has a couple of very large veins running down to Poupart's ligament, and then up to the upper part of the chest into the axilla. As we palpate the abdomen we find that except in the left upper quadrant it is not protuberant. The abdominal walls are quite rigid, although there is no particular tenderness. On palpation the most striking thing is the tumor mass which extends down to about a fingerbreadth below the navel; it comes over to just a fingerbreadth to the left of the middle line. You can feel the edge very distinctly. It is sharp and rounded, the surface is smooth, and he complains of a little tenderness when I press upon it, but I think this is due to the tenderness of the skin over it. The tumor lies right up under the ribs. It is very superficial, moves deeply with inspiration, and one can feel two well-marked notches on this edge. It is not worth while to go into the subject of what this tumor is because it is so manifestly a great big spleen. On palpating further we find in the

right upper quadrant a mass which comes down just below the navel and which I can grasp between my hands in the front and back. It feels like the right kidney, somewhat larger than normal, not tender. In addition to this I can feel the liver quite distinctly coming down about two fingers below the edge of the ribs in the nipple line, and in the median line it comes down to about two fingers above the navel. The surface is smooth—no irregularities at all. The lung-liver dulness anteriorly is at the lower edge of the sixth rib in the nipple line. I can feel nothing else abnormal in the abdomen.

In the groin there are two or three enlarged inguinal glands on each side, perhaps the size of small beans. In the axilla I can feel two or three glands about the size of peas. The epitrochlears I cannot palpate. There is no evidence of any free fluid in the abdominal cavity. The genitalia are entirely negative and the extremities show nothing abnormal except changes in the color of the skin, already referred to. The reflexes are all perfectly normal.

DR. WILLIAMSON: What is the matter with him? What is your diagnosis?

VISITOR: There must be something wrong with the circulation or with the blood.

DR. WILLIAMSON: The blood-pressure is 142 systolic, diastolic not noted. On the 19th, when he entered the hospital, the blood showed 13,120,000 reds, 35,000 whites, and the hemoglobin percentage was 135 (Sahli). The next day the red count showed 13,280,000. On the 22d, 13,544,000; on the 23d a little under 15,000,000 reds were present. This erythrocyte count is, I need hardly say, a most extraordinary one, and, to make sure of its correctness, I have repeated the count with the Buerker apparatus, which is by far the most accurate for enumerating the red cells. The count made by this apparatus gave just a shade under 15,000,000 reds. The coagulation time was taken with the Wright coagulometer, and the time was less than one minute. The fragility test was made, the hemolysis being complete in tubes 2, 3, and 4, but very trifling hemolysis in tube 5. The differential count showed 93 per cent. polymorphonuclear neutrophils, 1 per cent. large mononuclears, 2 per cent. small mononuclears, 3 per

cent. polymorphonuclear eosinophils. In a smear the reds looked quite normal or as if containing a little less hemoglobin than normal. There was no poikilocytosis. To be sure that the hemoglobin would be taken accurately, and because the ordinary hemoglobinometers are very inaccurate, I took the blood and examined it spectrophotometrically. It contains just 22 grams of hemoglobin per 100 c.c. of blood.

You will see from the charts, which are taken from an article by me in the Archives of Internal Medicine, that this is nearly as high a concentration as the normal infant has at birth. It is not very generally known that there is a great variation in the amount of hemoglobin at various periods of life, and that there is no such thing as a normal percentage of hemoglobin for all ages alike. While this was known as far back as Leichtenstern's day, the idea has not penetrated very deeply into the minds of most physicians, and we still hear of men, who should know better, taking the hemoglobin of, say, a mother and a year old child on the same instrument, making no allowance for the age variation. Now that, of course, leads to the treatment of many children for "anemia" who are, so far as their blood is concerned, quite normal.

I have, in the article mentioned, examined the blood of over 900 normal individuals spectrophotometrically, and, as you will see by an inspection of the chart, which summarizes the findings, the hemoglobin age curve is a very definite one. Now for this patient's age, between thirty and forty, the normal hemoglobin value is about 17 grams per 100 c.c. In our patient the hemoglobin is 22 grams per 100 c.c. Reducing this to percentage, we find that it is about 129 per cent. Now the erythrocytes varied between 13,000,000 and 15,000,000. Assuming 14,000,000 as the average, and calling the normal 5,500,000, we find the percentage of corpuscles to be 254. This is interesting, since it shows that while there is a considerable increase in the hemoglobin, this increase lags far behind the increase in the corpuscles in the ratio of 129 to 254, the color-index being just over one-half its normal value. It is plain, then, that whatever be the underlying pathology of this disease, in this case at least it effects an increase in the

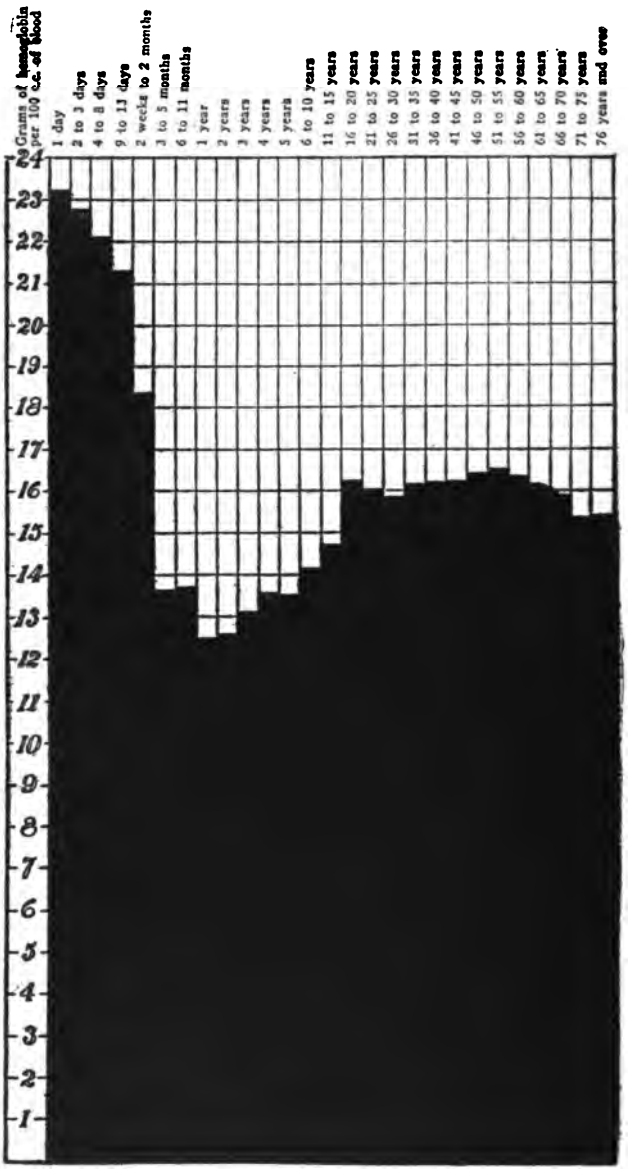


Fig. 217.—Grams hemoglobin per 100 c.c. of blood in persons ranging in age from one day to over seventy-six years.

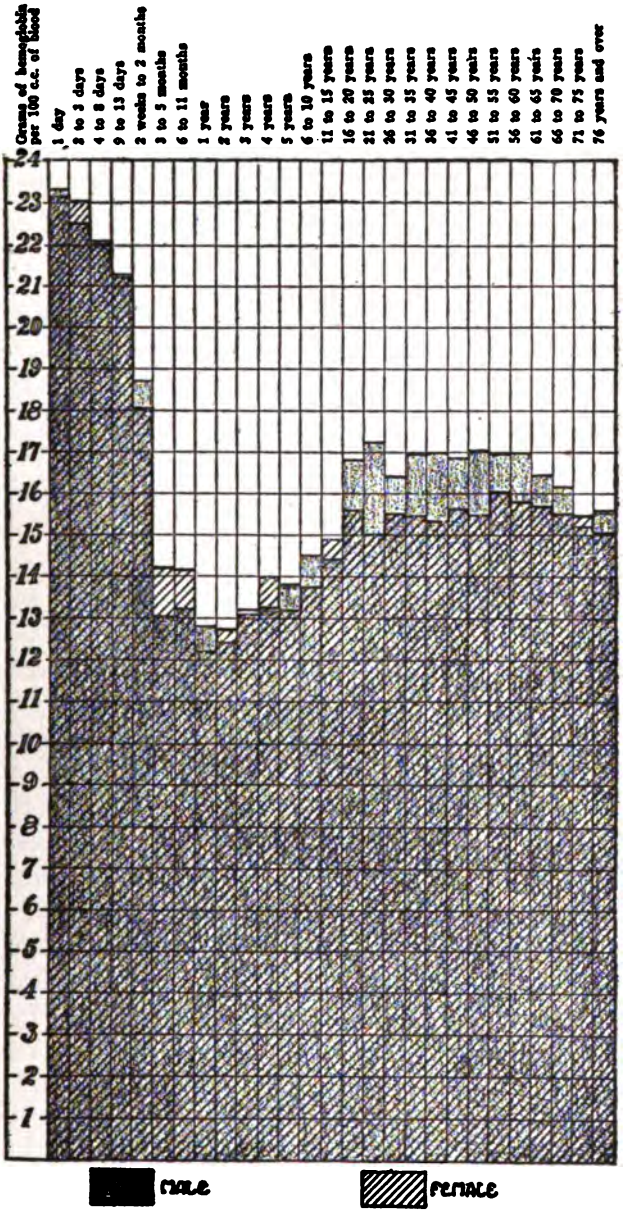


Fig. 218.—Grams hemoglobin per 100 c.c. of blood in the male and in the female, for the ages ranging from one day to over seventy-six years.

erythrocytes far beyond that of the hemoglobin, so that the impression we obtained by looking at the blood-film that the reds are a little paler than normal is amply justified (Figs. 217, 218).

The urine is clear, specific gravity 1020, amber color, acid reaction, a trace of albumin, no sugar. A centrifuged specimen shows an occasional hyaline and granular cast and one or two red cells. The feces showed nothing abnormal.

Now has anyone a suggestion to offer as to what is the matter with him?

When we analyze this case what are the salient points? The first thing is the enormous number of red cells. The second thing is the greatly enlarged spleen, and the third thing is the peculiar cyanosis. We classify the conditions in which there is an increase in the red cells in very much the same way as we classify the condition in which there is an increase of the white cells. In the case of the white cells we speak of leukocytosis and in some cases of leukemia. In the cases with increased red cells we speak of polycythemia. There are two groups of conditions in which we get the increased number of red cells. The first is the symptomatic polycythemias and the second is the primary condition, where there is no other disease that we can find. The secondary erythrocytoses are especially the congenital heart diseases. In these diseases we find every now and then increase in the red cells—7,000,000, 8,000,000, or even 9,000,000. This is sometimes temporary, and sometimes at autopsy we find changes in the bone-marrow. The normal yellow marrow of the bone becomes red. That is probaby the commonest case. Then there are increases in the red cells in conditions associated with cyanosis. We had a case recently with a much higher degree of cyanosis than this, but it was a purely mechanical cyanosis. They are usually temporary and do not represent a real increase in the cells, but merely an altered distribution. If the skin is greatly congested it simply means that there are more red cells in the skin than normal, and this may disappear if the cause clears up. Sometimes in mitral lesions we find this condition, but when the circulation improves the abnormal distribution tends to disappear. There is a peculiar type of intestinal disturbance

in which we find a peculiar type of cyanosis. Then we have a well-marked cyanosis in certain cases of chronic poisoning with certain coal-tar products. I have, within a year or two, treated a woman of great social prominence, whose cyanosis was becoming steadily greater. In her case it was due to liberal doses of a well-known proprietary drug containing acetanilid in large amounts. There is in these cases, however, no increase in the red corpuscles, so that they are readily distinguishable from the cyanosis of a polycythemia.

This patient has none of these conditions. His heart and lungs are normal. I very carefully demonstrated to you that there is nothing like a valvular condition, either acquired or congenital. In contrast with this we have the condition known as primary polycythemia, or erythremia—Vaquez's disease. Vaquez described this disease about 1899 or 1900, although he was not the first to report a case of it. Rendu and Widal had reported a case before. Osler also reported a series of cases. It is a rare disease. Up to 1906 there were about 50 recorded cases. Since then a number more have been reported, but I doubt if there are many over 100 cases in the literature now that are genuine instances.

I will give you a short sketch of this disease and then we will compare it with this case. The principal thing about it is the great increase in the number of red cells. This increase is constant, not dependent upon distribution. We find it in blood taken from a vein or from a finger. There is a constant high level. The second thing about the disease is the peculiar color. The face is a brick-red color when warm and intensely cyanotic when it is cold. The cyanosis varies a great deal; sometmes it is high grade and sometimes not. The third characteristic is the enlargement of the spleen in most cases. You see the findings are very typical. We have hundreds of conditions in which we have a diminished number of red cells, but the cases in which there is an increased number are very limited. The combination of increased red cells, the enlarged spleen, and the chronic cyanosis is an absolutely unique picture and practically pathognomonic.

This is a disease of adult life. The majority of cases have

occurred between thirty-five and sixty years of age. Two or three of the early cases showed a tuberculosis of the spleen, but it was afterward proved that the tuberculosis had nothing to do wth it because in some instances nothing was found in the spleen. As a rule, the spleen is only moderately enlarged—not the enormous enlargement found in leukemia.

As I said, the cyanosis varies greatly. I saw a case in Vienna in 1898 or 1899, before the disease was known. The patient was a woman with a big spleen and she was as blue as indigo. The case was studied and an autopsy obtained, but nothing came of it. It was not described at that time, but it undoubtedly was a very pronounced case of Vaquez's disease.

The Blood Features.—The principal feature is the erythremia —9,000,000 or 10,000,000 is an average case. The hemoglobin percentage is low as compared with the corpuscles. The patient may have 125 or 135 per cent. hemoglobin, so each corpuscle is not as rich in hemoglobin as the normal.

As to the white corpuscles, there is nearly always a moderate leukocytosis, and this is generally due to an increase in the polymorphonuclear neutrophils; occasionally there are a few basophils found, and occasionally a myelocyte. The blood is dark purple red and extremely viscid. The viscidity of the blood is enormously increased and that is of diagnostic importance. It clots very readily.

As a rule, we do not find any changes in the heart. One would suppose that with such a viscid blood it would produce a hypertrophy of the left ventricle, but ordinarily it does not.

These are the principal points of the disease. The etiology is almost unknown. So far as the morbid anatomy is known we know that most cases have shown that the yellow bone-marrow has been converted into red bone-marrow. The relation of the spleen has not been very well established, but most cases show some enlargement of the spleen. It is customary to divide the cases, but it is probably better to classify them all as erythremia or polycythemia.

Another interesting feature is that the total volume of the blood is increased; it is a real plethora. That has been deter-

mined in many ways. In this case, also, we attempted to determine the total volume of blood by the determination of the hemoglobin, spectrophotometrically, before and after a copious intravenous injection. Owing to the very rapid clotting our attempt was not successful. We shall attempt it again at the first opportunity.

The course and duration of this disease is chronic and it extends over a number of years. In most cases there are marked remissions; the patients get better and worse, but the great majority of cases die after a greater or lesser interval of time. The prognosis is, in most instances, fatal. As you see, it is a disease which presents very striking features. We might ask ourselves whether there is any other condition in the spleen which could present this picture, and we would have to say "No." Tuberculosis, syphilis, endothelioma, and Gaucher's disease do not. It is a peculiar disease and the etiology is at present unknown.

The cardinal diagnostic points are these: A patient with (1) a moderately high-grade erythremia, (2) with a moderate increase in the whites—the increase being principally in the polymorphonuclear neutrophils, (3) with an enlarged spleen, and (4) with or without a high blood-pressure. With these present there is practically no chance of going wrong. You must rule out all conditions due to intoxications, to other diseases of the spleen, and all heart diseases. The majority of cases of congenital heart disease do not live to adult life, but this must nevertheless be considered.

The treatment of cases of this sort is thankless. The one thing that should not be done is to remove the spleen. That hastens the fatal issue. The best results have been said to be obtained by x-ray treatment, and that is what we are using in this case. I am decidedly skeptical as to its value. Frequent bleedings have been advocated, and we shall probably do that in this case also.

As I said before, the cases are extremely rare. I was shown a very mild case two months ago in another city, but one usually goes for a great many years without seeing a case.

CLINIC OF DR. M. MILTON PORTIS

COOK COUNTY HOSPITAL

LESIONS OF THE RIGHT UPPER QUADRANT OF THE ABDOMEN. DIFFERENTIAL DIAGNOSIS

YOU have had presented to you 8 cases showing different types of lesions of the right upper quadrant of the abdomen. In most of these the diagnosis was definitely made because of the clinical, laboratory, and *x*-ray evidence which you have just gone over. I purposely selected typical cases so that you could make the diagnosis more clearly. However, most of the cases that will come to you for such a diagnosis will not be so definite, and it will be your problem to consider atypical signs and findings in weighing the points for or against a diagnosis.

From the outset I wish to make clear that the more my experience increases, the more am I less inclined to accept a diagnosis of a functional disturbance of the stomach. The terms "hyperchlorhydria," "hypersecretion," "nervous cardialgia," and a host of others, all of which signify neuroses or functional stomach troubles, and are accepted by many as a diagnosis, I am growing more convinced are merely a cloak for our ignorance. Evidence of the operating room as well as autopsies shows a large part of these cases to be sufferers from organic disease. The percentage of functional cases will always be with us, but it will grow decidely smaller as our knowledge increases.

The differential diagnosis of lesions of the right upper quadrant of the abdomen in the typical cases is very easy. In the atypical cases, especially those associated with complications, the diagnosis is not only extremely difficult, but at times impossible. Before giving the differential points I shall, for the sake of clear-

ness, give the important signs and symptoms of these lesions, especially those which are of importance in the differential diagnosis.

The *peptic ulcer* of the stomach occurs more commonly in women, in young adult life. Some cases are latent in their picture, while many present symptoms of hyperchlorhydria with pain from time to time. The onset is insidious, at first with a feeling of fulness and distress, and then later pain, nausea, and vomiting.

Pain is the most important of the symptoms, and the time of its appearance helps to distinguish gastric from duodenal ulcer. Generally it appears a few minutes after eating, but may be delayed to an hour. It is made worse by food, especially coarse food, and increased by epigastric pressure. If vomiting occurs, pain is relieved. The pain is of a burning or gnawing character and not cramp-like. When the pain is continuous, then some complication is present, and we no longer have a simple gastric ulcer. Sometimes the pain is referred around to the back and there is also tenderness in the region of the tenth dorsal vertebra, especially to the left of the spine. Boas attaches a diagnostic importance to this tenderness and has devised an algesimeter to measure it. A localized epigastric tenderness is usually present.

In all of the cases hemorrhage occurs sooner or later, and it is a complication. In most of the cases the blood can only be detected by chemical or microscopic methods in the stomach contents or the stools. In many, however, it is a visible hemorrhage. According to the amount of blood lost, the effect on the patient and the appearance of the patient will vary, and the blood, if large in amount, will be bright in color, and dark if small in amount, especially if it has remained for any length of time in the gastro-intestinal tract. *Usually* death does not occur from hemorrhage from a gastric ulcer.

Vomiting does not occur in *all* gastric ulcers, but it is common, and when it does occur it is usually at the height of digestion, *i. e.*, two or three hours after eating.

The examination of the stomach contents in 95 per cent. of the uncomplicated cases shows a hyperchlorhydria in which the

free acid and the total acid may be two or three times the normal. Occult blood is usually present and macroscopic blood is common.

The motility test in uncomplicated ulcer shows a premature emptying of the stomach.

Duodenal ulcer is more common in males from twenty to forty. Patients at first complain of a general discomfort and sense of weight. Later they complain of pain two or three hours after eating. When liquids are taken, pain comes earlier. The pain is relieved by taking food. Moynihan describes the pain as a "hunger-pain," and says it often wakes the patient in the early morning. This is relieved immediately by taking food or alkalies, and the patient goes back to sleep.

There is at times tenderness in the epigastrium a little to the right over an area 2 or 3 inches in diameter. The upper part of the right rectus muscle may show some rigidity.

Many cases exhibit a *periodicity* to attacks and complete abeyance between attacks. These may follow exposure to cold or wet, indiscretion in diet, or mental shock or worry. Again, the attack may be cut short by rest or by a vacation. *Chronicity* is a common story, and cases may extend over as many as forty years, with periods of intermission.

When a stage of obstruction due to contraction of an ulcer scar or adhesions occurs, then we get a characteristic picture of motor insufficiency. Peristaltic waves are visible on the external surface from left to right, and inflation shows the presence of the large stomach.

Hemorrhage is a complication, and is a *late symptom*, for it usually means erosion of a deep vessel. The ulcer should be recognized before this stage. Occult blood is present in every case, and will always be found if sought for repeatedly.

The *stomach test* in *recent* duodenal ulcer usually shows a hyperchlorhydria just as in gastric ulcer. In the *chronic cases*, however, the titrations may show subacidity. The motor power is very good if no mechanical obstruction is present, and the stomach may even empty too quickly.

In the differential diagnosis of gastric from duodenal ulcer

the time of the pain is very important. If it appears early, within an hour, it speaks for a gastric ulcer, while after two hours it means a duodenal ulcer.

The recurrence in seasons occurs in duodenal cases.

Vomiting is more common in gastric ulcer and rare in uncomplicated duodenal ulcer.

Gastric syphilis may so closely simulate ulcer and cancer that it must always be considered in the diagnosis. Evidence of syphilis in other parts of the body, a positive Wassermann with the blood or spinal fluid, *x*-ray evidence which does not fit carcinoma and has some characteristic things in favor of lues, improvement under treatment—all are definite factors in deciding the diagnosis. If the case should be operated upon and tissue removed in which spirochetes are demonstrated then only can you have a positive diagnosis.

Disease of the gall-bladder in typical cases is easy of recognition, but in atypical cases the symptoms are anomalous, and difficulties of diagnosis arise which are almost insurmountable.

The presence of jaundice with a gall-stone attack makes the diagnosis easy. However, many patients never have jaundice. Likewise, the finding of gall-stones in the stools determines the diagnosis—but in most cases no stones are passed. Gall-stones are more common in women, especially middle aged. A history of a previous attack of typhoid is important.

The *pain* in gall-stone colic is excruciating—much more so than ulcer unless the ulcer is in the perforating stage. The pain occurs independently of eating, is not relieved by food, and may even be made worse by it. The pain is felt in the right upper abdominal region and is often referred to the right shoulder-blade. It appears within an hour of food taking, *especially after greasy foods*.

Chilliness or even a chill may accompany a biliary colic and fever may be present. Vomiting occurs soon after the initial pain, and often with sweating and depression. Nausea and vomiting occur in gall-stones without colic, leading the patient to believe that the trouble is with the stomach.

Tenderness over the gall-bladder is common, and one may palpate tenderness of the liver in the region of the gall-bladder or find a Riedel lobe that is tender.

The *stomach test* shows a normal stomach-picture with normal motor power unless there are complications present such as common duct stone or adhesions causing mechanical obstruction; often a subacidity is found and rarely a hyperchlorhydria.

Perforation of a gastric or duodenal ulcer will produce a similar picture to a severe gall-stone colic.

In perforation there is an acute, violent, tearing, constant pain, followed by collapse, rigidity, tympanites, and loss of liver dulness. A *leukocytosis* occurs quickly, and soon the picture of generalized peritonitis begins, or if subacute perforation has occurred, a circumscribed abscess and extensive adhesions to other organs may result.

Cholecystitis, with or without gall-stones, may simulate ulcer. A pyogenic infection of the biliary passages is usually associated with chills and fever and a leukocytosis. Besides localized tenderness over the gall-bladder area, there are frequently the signs of cholangitis. The absence of the laboratory and clinical findings of the other lesions mentioned is a great help in the differential diagnosis. With adhesions between the gall-bladder and pylorus, motor insufficiency of the stomach may be present. In the interval between attacks of cholecystitis, tenderness can often be elicited over the gall-bladder, especially on deep palpation.

Cancer of the stomach, especially of the pylorus, may cause difficulty, for it frequently occurs on an ulcer basis. The cases with metastatic growths are easy of diagnosis, but before metastasis occurs one can still make the diagnosis by the history and by the palpation of a tumor mass, cachexia and anemia, and the laboratory findings for carcinoma, especially the absence of free hydrochloric acid, and the presence of the Boas-Oppler bacilli along with lactic acid. Numerous biologic tests have recently been developed for the early diagnosis of carcinoma, such as the Salomon test for albumin in the fasting stomach contents, the tryptophan test, the Abderhalden test, and the

complement-fixation test of von Dungern. Although all of these are helpful, none are infallible.

The attacks of *gastric crises* in locomotor ataxia have often been misleading in the diagnosis of these lesions. Many cases, I am sorry to say, have been operated upon with a mistaken diagnosis of gall-stones or ulcer. If a careful physical examination is made such mistakes can be avoided.

The *colic* which occurs in *lead-poisoning* may also be confusing, but here again a careful history and physical examination will avoid mistakes. The referred pain in *appendicitis* or the pain of an abnormally high appendix may give the picture of pain in the upper abdomen, with nausea and vomiting. These cases are all the more confusing because an appendicitis is not infrequently associated with a gall-bladder disease or a duodenal ulcer. The *Dietl crisis* of a floating kidney may give a confusing abdominal picture, but here again the history of an intermittent discharge of a large amount of urine with an improvement of the clinical condition following it, as well as a careful abdominal examination, and, if necessary, a catheterization of the ureters, will make the diagnosis certain. The sudden pain associated with *renal calculus*, *renal new growth*, or a *renal infection* may be confusing, but here again the careful physical examination and a study of the urine with or without ureteral catheterization will help to clear up the diagnosis. Permit me to emphasize to the uninitiated that an examination by all methods, including the *x*-ray, must cover both kidneys, both ureters, and bladder if mistakes are to be avoided, no matter which side is seemingly *the cause* of symptoms. *The rupture of an extra-uterine pregnancy* or an *ovarian cyst* may also give a confusing picture, but this can be eliminated by a pelvic examination. The *colic associated with the passage of some indigestible matter through the bowel* or the acute gastro-enteritis following an indiscretion in diet must also be considered.

Diseases of the *pancreas* and *tumors* of the pancreas are very confusing in the diagnosis of lesions of this region. The diagnosis must largely be made by exclusion. One should never forget the picture of acute pancreatitis with a severe colic, nausea,

vomiting, and collapse, which resembles very closely the picture of perforating ulcer or the rupture of the gall-bladder or the appendix. A localization of the tenderness to the epigastrium, along with a circumscribed distention in this region, and particulary the picture of shock and collapse out of proportion to the other findings, should help make one alert for acute pancreatic disease.

Tumors of the pancreas are troublesome in diagnosis, particularly tumors of benign origin. Malignant tumors of the pancreas are most frequently at the head of the pancreas, and very rapidly produce obstruction of the biliary tracts, jaundice comes on, usually the gall-bladder is palpable, and the laboratory tests are negative for the stomach and bowel. The *x*-ray is negative for disease of the stomach and bowel, but there is frequently *x*-ray evidence of widening of the duodenum as it follows around the head of the pancreas, which is enlarged. The final diagnosis, however, in disease of the pancreas will depend largely upon exclusion of other organs. Stool study for the presence of gas deserves mention, but stool studies are not as satisfactory as the text-books would lead us to believe. You will arrive at your diagnosis by excluding other things.

An *acute intussusception* should be considered very carefully, for it will give a very confusing picture, but the abdominal examination will show, if it is high up, a rather flat abdomen, and if the obstruction is low down, a markedly distended abdomen. Nausea, and vomiting which soon becomes fecal, and *x*-ray evidence which is definite, showing the place of obstruction, all are helpful factors.

I have not attempted to consider infrequent or rare lesions which may cause symptoms or signs in the region considered, for this would necessitate a clinic of unusual length. A diaphragmatic pleurisy, pneumonia of the lower right lobe, subdiaphragmatic abscess, splenic anemia, and syphilis of the liver may give rise to findings in the upper abdominal quadrant. The definite physical, laboratory, and *x*-ray findings of these lesions will help to eliminate them in the differential diagnosis. The last named, syphilis of the liver, deserves special mention,

for the clinical picture is so variable and the history often impossible to determine. The picture of gall-stones may be simulated very closely by syphilis of the liver, and it is well, whenever the slightest doubt that a liver pathology is present, to have a Wassermann test made.

In a previous issue of the MEDICAL CLINICS OF NORTH AMERICA (Boston Number, January, 1918) Dr. Arial W. George, Dr. Ralph D. Leonard, and Dr. Frederick W. O'Brien have a splendid article on the *x*-ray diagnosis of diseases of the upper right quadrant, and I will refer you to that clinic for information concerning the *x*-ray findings in these lesions. I can heartily endorse the statements made by these gentlemen, and wish to emphasize that the *x*-ray must always be taken into consideration in making the diagnosis, along with the clinical and laboratory evidence which I have submitted to you today.

CLINIC OF DR. ARTHUR R. ELLIOTT

ST. LUKE'S HOSPITAL

SYPHILIS OF THE AORTA

WE have every reason to believe, both from pathologic study and from practical clinical experience, that the vascular lesions of syphilis constitute the most important changes that are observed in that disease. The endarteritis of syphilis is responsible not only for most serious disintegrating effects upon the circulatory organs but also for many nutritional defects in the organs and tissues generally, this factor being especially important in syphilis of the nervous system. One effect of the renewed interest in syphilis which has been one of the most notable features of clinical pathology during recent years has been a revaluation of the pathologic processes which we associate with that disease. In consequence of this, certain processes occurring late in syphilis, and formerly regarded as nutritive secondaries rather than direct infectious processes, have been taken out of their ancient separate classification as parasyphilis, and placed where they really belong, in the list of true syphilitic inflammatory lesions. Among these none is more important than syphilitic arterial disease and its consequences—aneurysm, aortic regurgitation, angina pectoris. The arterial disease of syphilis is a distinct type, differing from non-specific arterial disease in several essentials, chiefly its mode of development, its usually focal distribution and the general absence of regressive metamorphosis, especially calcification. Microscopically, the endarteritis of syphilis is differentiated from the non-syphilitic variety by the fact that the primary seat of the change is in the media and adventitia along the course of the vasa vasorum, any thickening of the intima that comes to pass being secondary in production. Conversely, in non-syphilitic

types of aortic disease the histologic change begins in the intima and predominates there. The true type of syphilitic involvement consequently occurs only in arteries that are supplied with vasa nutritia. This is why it is so often found in the brain because in the cerebral circuit even small arteries possess vasa vasora, whereas vessels of similar caliber in the extremities not being so provided escape these specific changes. For the same reason we find the ascending portion of the aorta to be usually the primary seat of change in syphilitic aortitis, in contrast to ordinary arteriosclerosis, wherein the changes are briefly situated in the descending aorta. The primary and particular process at work is a chronic indurative, inflammatory involvement of the tunica media of the aorta due to infection by the spirochete. No matter what the end-product may become—dilatation, aneurysm, or valve defect—the lesion is an aortitis. Perhaps in no organ or location of the body is the lesion observed so generally syphilitic as in the aorta. It is true that inflammatory involvement of the aorta has been described as resulting from other infections, but so far as clinical appreciation is concerned they are of small consequence as compared with syphilis. Aortitis may, of course, result from acute rheumatic arthritis and from streptococcus infections generally, and less frequently perhaps may follow other severe acute infections. When the aorta is involved in rheumatism or other acute infections, however, this usually occurs in association with endocarditis and manifests the tendency common to all acute infective secondaries to undergo spontaneous subsidence as the primary cause subsides. Syphilitic aortitis, on the contrary, is a progressive lesion until checked by appropriate therapy directed against the syphilis itself, and manifests even to a greater degree than is apparent elsewhere the peculiar obstinacy which characterizes syphilitic foci. From the frequency with which syphilitic aortitis is encountered accidently at autopsy, according to the statistics of Eich in 42 per cent. of cases, we may assume that the infection of syphilis is harbored in that part of the vascular system for years without detection; indeed, it might even appear that the aorta is one of the most frequent stations in which the infection may obscurely lurk in latent syphilis. From the

practical clinical standpoint accumulating evidence is forcing the conclusion that a persistently positive Wassermann reaction in a patient without evidence of syphilis in the skin, mucous membranes, or nervous system points to the aorta as the next most probable seat of the disease. Larkin and Levy examined the aorta in 19 cases which showed positive Wassermann tests during their course: 17 of these 19 aortas gave evidence of aortitis; 11 of the 19 patients (60 per cent.) died from aortitis and its consequences. Citron used the Wassermann test in all chronic cases of aortic regurgitation, finding it positive in 60 per cent.; Collins and Sachs' percentage in a similar investigation being 84. Warthin, in his very interesting investigations, finds active lesions of the aorta in every case of latent syphilis examined. Bearing in mind this frequency of aortitis in latent lues, it is well that we should consider the possibility of a syphilitic etiology in any case of cardiovascular degeneration of obscure origin. In the majority of cases syphilitic aortitis is a very chronic process having a long latency. Many years may elapse between infection and death with anatomic confirmation of aortitis. About 30 per cent. of all syphilitic patients with clinical aortitis are found to have developed aneurysm, and about an equal percentage sclerosis and retraction of the aortic valve. Before either one of these mechanical defects results the disease is usually latent. After they appear, progress is rapid, often bringing life to an end within two or three years. Early in the course of aortic syphilis involvement of a limited portion of the artery may appear of slight immediate significance, but with its further development may ensue dilatation, aneurysm, angina pectoris, or, most commonly, aortic regurgitation. To detect this insidious lesion before it has advanced to the production of mechanical secondaries is of the greatest importance, clinical recognition enabling us in its earlier stages to forestall the development of these defects by active antisyphilitic treatment. The diagnosis is often extremely difficult, since limited and circumscribed changes in the ascending portion of the aorta without involvement of the valve ring are seldom accompanied by clearly defined symptoms or signs. The greatest difficulty is encountered in individuals not recognized as syphilitic. It is

often the case for aortitis to be the only manifestation of the disease in otherwise latent syphilis, and one may expect in a considerable percentage of cases to encounter a completely negative history of syphilis. The majority of patients coming under clinical recognition for aortic syphilis are in middle life, and experienced clinicians understand the significance of angina pectoris and aortic regurgitation originating in the adult.

The foregoing considerations briefly outlined indicate to you the main points of clinical interest involved in syphilis of the aorta. In this region of the body we observe the full brunt of the disease so far as it effects the arterial system. That the aortic tunic is, of all tissues of the body, the most frequently involved in syphilis is a growing belief. When involved by the localization of the spirochete a chronic inflammatory degeneration is started which may in time result in the most complete disintegration at the very center of the circulation. Aortitis is not unlike nervous forms of syphilis in its long latency and the obscurity of its earlier clinical manifestations, but differs widely from them by virtue of the fact that mechanical factors at work in the aorta abridge the later stages of the disease, hurrying along the termination, when they become operative. That so many cases of syphilitic aortitis escape detection until they have reached the stage of dilatation, aneurysm, or valve defect is a reproach to our methods of diagnosis and shows our lack of appreciation of this common manifestation. A better appreciation of the incidence of nervous syphilis exists, so that examination of the reflexes and of the cerebrospinal fluid is becoming a routine in the examination of the syphilitic. On the other hand, unless the blood-pressure is found elevated or a murmur exists, or the patient has some painful or disturbing symptom referable to the heart, the clinical examination does not comprehend a special investigation of the heart and aorta in the syphilitic. This is neglect, since modern methods of *x*-ray study of the aorta and heart, carried out in a routine manner, would enable us to detect the existence of most cases of syphilitic aortitis before they had advanced to the stage of serious degeneration. It is to illustrate the capabilities of this method in diagnosis of aortic disease that I shall present a num-

ber of cases, selecting them with the idea of demonstrating the disease in its various stages.

One of the most notable features of syphilis of the aorta is its point of election. It is the suprasigmoid portion of the aortic arch that is the seat of localization in early stages of involvement, from whence it spreads in both directions, threatening, on the one hand, the integrity of the coronaries and aortic valves, and on the other extending until it has involved perhaps the entire extent of the arch. Although primarily a small celled or granulomatous infiltration of the middle and outer coats of the vessel, secondary changes sooner or later become established and may be extensive. These are characteristic not by calcification, as in senile ateriosclerosis, but by gradual corrosion, so that at points thinning of the vessel wall may give rise to aneurysmal bulging or possibly a true saccular aneurysm. An equally characteristic alteration observed is cellular infiltration about the mouths of the branches of the arch, with, it may be, a distinct narrowing of the innominate or left carotid or more or less occlusion of the coronaries. In the earlier stages the vessel is perhaps but little dilated or deformed, so that the aortic shadow in the roentgenogram may display no alteration in form. It will be obvious that until there is some dilatation or alteration of curve, or at least some abnormal pulsation of the vessel, Roentgen diagnosis is not available. In consequence of this fact, the *x*-ray cannot be relied upon for the detection of aortic syphilis in the early stage. By way of illustration of this fact, we may consider briefly the case of W. B., a colored waiter, twenty-one years of age. This man complains of a persistent aching pain in the left shoulder of about two months' duration. It does not vary much in severity, although he states that sustained activity increases it somewhat, and may develop a dry paroxysmal cough and at times palpitation. Another suggestive symptom is recurring substernal soreness. His general health has, in the main, been satisfactory, and he has continued his occupation with no greater penalty than some aggravation of his symptoms on exertion. He acknowledges syphilitic infection two years ago. Upon examination, the interesting fact develops that firm pressure over the manu-

brium sterni causes a deep-seated aching soreness which persists for some time after pressure has been withdrawn. His heart is normal in size, but on listening to the heart sounds we find along the left border of the sternum a faint diastolic whiff. The blood-pressure is systolic 155, diastolic 85, pulse-pressure 70. The blood Wassermann test is positive. This man's symptoms and physical findings leave us in no doubt that he is developing aortic disease. The blood-pressure picture, diastolic murmur, the peculiar subjective phenomena, and positive Wassermann establish that beyond reasonable question. The *x*-ray plate (Fig. 219)

Fig. 219.

which I show here fails, however, to reveal anything of significance. The heart is normal in size and shape, and there is no change either in width or outline of the aortic shadow. There is not the slightest reason in such a case why we should admit that the negative *x*-ray evidence detracts from the value of our clinical conclusions. The man's syphilis is comparatively recent, about two years, and changes in his aorta have not yet advanced to the point of producing either stretching or bulging. I may add, by way of support to the diagnosis of aortic syphilis, that active antisyphilitic treatment has gradually improved his subjective discomforts,

although, of course, the physical findings remain the same. In this case we are dealing with aortic syphilis in its earliest clinical stage. It is comparatively rare that we have the opportunity of so clearly appreciating this form of syphilis as is offered us by this example. Aortic syphilis ordinarily has a long latency, during which the symptoms, if any, are so obscure or so trifling as to seldom arrest the attention. This has given rise to the belief that syphilitic aortitis is a late development in syphilis, but I am inclined to think that this is more apparent than true, due partly to the symptomatic latency of the infection and partly to our

Fig. 220.

lack of thoroughness in examination and carelessness in the interpretation of slight symptoms. The vast majority of cases coming under clinical recognition are in mature syphilitics, the average duration of the syphilis being probably fifteen to twenty years before the development of severe mechanical defects, such as aneurysm, aortic regurgitation, or angina pectoris. From all that we know of the life history of sclerotic processes it needs no argument to convince one that slow destructive processes must have been at work for a long period to produce the profound disturbances which bring the majority of these cases under clinical

observation. Yet it is not always the slow process that ordinary clinical experience would indicate. Occasionally a case will be observed where the progression of events has been rapid. Longcope reports an instance where rupture of the aorta occurred three months after the primary lesion, and Brooks records instances of rapid development within a few months after infection. I show here in this connection a roentgenogram taken eighteen hours before death (Fig. 220). This shows a greatly enlarged heart, increased in both long and broad diameters; the aortic shadow is increased in breadth and elevated, reaching as high as the sternoclavicular angle, and the lungs are suffused with a dense hypostasis. The patient who furnished this illustration was a colored porter aged twenty-five; he had a luetic infection five years before death and, like many colored syphilitics, he received no systematic treatment. He remained in, what appeared to him, satisfactory health until about ten days before coming to the hospital, when, one evening on his way home from work, he was overtaken by severe precordial pain and intense dyspnea. Although these symptoms abated somewhat in severity, he was unable to lie down with comfort, coughed much, and the slightest exertion caused distress. Upon his admission to the hospital he was found to have aortic insufficiency, relative mitral regurgitation, and pulmonary hypostasis. The heart was enormously enlarged, the blood Wassermann positive. He died one week after entrance; no autopsy was obtainable. This case furnishes us an illustrative instance of how rapid the progression of aortic disease may be. The determining factor of how soon aortic change may come to light in syphilis is not the duration of the syphilis, but the activity of the process in the aorta.

We have no easily recognizable clinical criterion that we can bring to bear for the recognition of aortic change. It is a curious and important clinical observation that the aorta may be greatly degenerated, although the peripheral arteries apparently remain normal. The tones at the base of the heart yield us, perhaps, some information of value, and yet not every direct aortic murmur in a syphilitic, nor, on the other hand, every reverberant second aortic tone, point indubitably to syphilitic disease. It is possible for the

mature syphilitic to have enough senile change of simple sclerotic character in his aorta and aortic valve to give rise to these manifestations. As the matter stands at present the *x*-ray constitutes the best source of information that we can bring to bear in the identification of these cases.

We shall not be in a position to intelligently employ the *x*-ray in estimating the amount of damage done to the aorta unless we are already familiar with the appearance of the adult aortic shadow in health and in the more common non-syphilitic diseases; in other words, we must have a standard for comparison. For example, some dilatation of the aorta is one of the most common findings in roentgenography of the heart. It is practically always present in high blood-pressure states, in nephritis, and arteriosclerosis. It often exists, on the other hand, as the only characteristic of the aortic shadow in syphilitic aortitis. Interpretation in such cases rests upon serologic findings, the clinical history, etc. No arbitrary interpretation of alteration in outline is, of course, justified. It is only when all facts are assembled that definite conclusions should be drawn. The dilatations of the aorta resulting from syphilis may assume a variety of forms depending upon the extent and severity of the inflammatory process; thus, when the infection is localized at some particular point, a focal bulging may develop, whereas if it is widely diffused and not very active, a general dilatation of the vessels is likely to follow. Sometimes the dilatation is irregular, giving the impression of two or more fusiform aneurysms. Again, it may result in a single typical fusiform aneurysm, while in still other instances sharply focal lesions lead to the formation of one or more saccular aneurysms.

Let us consider for a moment the normal aortic shadow in the roentgenogram (Fig. 221). It will be seen that it lies in its first portion behind the sternum and does not project beyond the right auricular curve. At the arch where it curves backward and to the left there appears a more or less well-rounded knob to the left of the sternum well above and distinct from the cardiac shadow. This so-called "aortic knob" may well merit special attention, since it is one of the striking anatomic peculi-

Fig. 221.

arities of this area, and its alteration in form possesses some value in diagnosis. This knob is not equally well defined and prominent in all normal aortæ. It may be so prominent a feature as to be mistaken for an aneurysm (Fig. 222), whereas in the asthenic pear-shaped or "dropped" type of heart it may hardly show at all (Fig. 223). It varies in prominence according to age, being less well defined in early life than in adults. In the aged and senile sclerotic the shadow is apt to be pretty sharply outlined, its edge intensified by sclerous thickening and lime deposit (Fig. 224). It is less apt to be a prominent feature in adult females than in males of corresponding age. It may not be necessary to emphasize the fact that a certain amount of varia-

Fig 222.

Fig. 223.

Fig. 224.

tion from the normal is common in health. That is true of all features of cardiac roentgenograms. It can hardly be said that there is a fixed type of normal heart; the heart fits the body.

In one healthy individual it may be a short, rather wide heart, with a relatively broad aortic shadow, and in the next healthy individual of equal age, who has a longer chest and a lower vascular tone, the roentgenogram may show a heart of long type with a narrow aorta.

In aortitis the *x*-ray reveals two kinds of change, namely, alteration in density of shadow and change in contour. In early aortitis the pathologic process is almost invariably localized to the first portion of the aorta near the aortic valve. As

Fig. 225.

the vessel at this stage is but slightly thickened, there may be merely a doubtful dilatation of the first part of the arch, with exaggerated pulsation at that point. In such cases the heart is rarely enlarged; with the progression of the aortitis the artery becomes more and more dilated, and as a result the aortic shadow as it ascends from the heart is widened, so that it projects beyond the outline of the curved right auricle (Fig. 225). In most instances the shadow is regular, but it may display slight bulging or protusion. Should dilatation extend to the transverse arch, the knob may lose its well-defined curve, becoming flattened and

broadened. These, in outline, are the anatomic features of the simple type of syphilitic aortitis. Aneurysms should publish their presence by alterations of curve that immediately arrest attention. It hardly requires emphasis at this day that the *x*-ray furnishes the only reliable means which we possess of detecting small aneurysms. While in the earlier stages of aortitis Roentgen evidence consists merely of increased curvatures, dilatation, and abnormal pulsation without notable increase in the size of the heart, we find sooner or later as time goes on more or less characteristic change in the size and shape of that organ. In the later

Fig. 226.

stages of aortitis the heart constitutes one of the most characteristic features of the roentgenogram. An increase in size develops gradually whether aortic insufficiency is present or not. This increase effects to a much greater degree the long diameter than the broad diameter of the heart, the heart assuming a position more nearly horizontal than normal, producing a boot-shaped shadow. This type of heart shadow is very similar to that seen in high blood-pressure states. The marked pulsation of the left ventricle seen on the screen in hypertensive states is less emphasized in aortitis. This type of heart has been termed the aortic heart (aortic configuration, Fig. 226) in contradistinction to the

broad or bag-shaped heart of mitral disease (mitral configuration). The spread of the disease to the aortic valve with the production of aortic insufficiency greatly augments the heart shadow, and its horizontal configuration is correspondingly magnified. In advanced cases relative mitral insufficiency is superadded, with the effect of producing an enormously bulky shadow, the true cor bovinum. Good examples of this, the cardiac end-product of aortitis, are the two plates that I show you (Figs. 227, 228). One of these (Fig. 227) represents the heart of a man who was put to

Fig. 227.

Fig. 228.

bed in the hospital eighteen months ago with a badly ruptured compensation. He was markedly edematous and had much pulmonary hypostasis and the cardiac signs of insufficiency the result of syphilis of fifteen years' standing. I refer to his case because this man is still living and during the past winter has been employed as a Pullman car conductor. I must say that it is rare to see a patient who has advanced to the point of cardiac decompensation with aortic insufficiency, reduced to so extreme a state as was this man during the summer of 1916, live so long a time and regain his activities. Ordinarily, developments of this

character warrant the most serious prognosis, for it is well known that aortic insufficiency of syphilitic origin does very badly, the prognosis being vastly graver than in non-specific types of aortic disease, probably because the lesion is progressive and the myocardium ordinarily placed at disadvantage because of coronary involvement. While we are mentioning coronary involvement in syphilis, it is interesting to refer to a patient recently under observation, a plate of whose heart I now throw on the screen (Fig. 229). This man, fifty-four years of age, contracted syphilis twenty-five years ago. Being a man of means and intelligence,

Fig. 229.

he secured what was considered at the time adequate treatment, and was assured at the end of three years that he was cured. A few months before I saw him he developed pain in the precordium following exertion. At first recurring at considerable intervals, these attacks grew in frequency until it was impossible for him to carry on his affairs because any exertion beyond the simplest character brought on severe pain. The pain was accompanied by a sense of iron-like constriction across the chest, severe dyspnea, and a sense of suffocation. These symptoms yielded promptly to nitrites and rest. Upon examination of his heart

it was found to be enlarged, his blood-pressure elevated, and he had an aortic direct murmur. The Wassermann was positive. The interesting feature of this man's case is that after six weeks spent in the hospital with intensively administered antisyphilitic therapy comprising, among other measures, 2½ grams of salvarsan in small doses at three-day intervals, his heart pang entirely disappeared, and for two months he has had no attack, although during this period he has made a long railroad journey and has indulged in moderate activities. The syphilitic origin of angina pectoris is, of course, familiar. That so marked benefit may accrue from antisyphilitic therapy in this condition opens an encouraging prospect for many of these poor sufferers.

That so marked an improvement secured in the case cited was not coincidence or accidental happening would appear from my experience in other cases, notably in the case of an old syphilitic who at the age of sixty-five developed angina pectoris so badly that he was completely invalided, so slight an exertion as turning in bed without the assistance of the nurse being sufficient to precipitate an attack. Despite the discouragements offered by so extreme a development, an attempt at specific relief was made by administering ½ decigram of neosalvarsan intravenously every third day. After the third dose slight improvement was observed, and the treatment was continued with gradual increase in dosage. A dose of 3 decigrams was finally reached, with so good effect that his attacks declined in frequency and abated in intensity, so that he was able to be out of bed and about his apartment and lived in fair comfort for a number of months before he died. If due care is exercised in carrying out antisyphilitic therapy in angina pectoris, it seems to me that it should always be attempted. I need not insist that the first dose should be very small and subsequent injections regulated by the reaction following that preceding.

The vast majority of cases that come under clinical recognition for syphilitic aortitis have passed through the latent stage and developed symptoms referable to the circulation. The methods of physical examination in these cases will usually reveal some alteration of the heart or change in the circulatory

rhythm or blood-pressure, but it may not be apparent that syphilis is the underlying cause until the point is inquired into or the blood examined for the Wassermann. Even should the Wassermann test prove positive or the man confess syphilis, the conclusion is not at once obvious that his circulatory disturbance is of syphilitic type, since there is no exemption among syphilitics from blood-pressure and myocardial defects resulting from causes quite other than syphilis. The shape of the heart and especially of the aorta as revealed by the *x*-ray may convert the probability of the case being syphilitic almost into a certainty, should it prove typical.

The next case that I have to show you may serve to illustrate how a case of this kind may work out. This man is forty years of age and his chief complaint is uncomfortable heart action. He has much belching and is greatly troubled by irregularity of the heart, especially at night. His general condition is characterized by a lassitude and lack of endurance, which is very different from his former habit. He confesses to syphilitic infection occurring eleven years ago, for which he took treatment covering a period of two years. He has had several Wassermanns made on the blood, all of which have been reported negative. Physical examination reveals an enlarged heart, and with the stethoscope can be heard a rough short systolic murmur in the aortic area. There is a premature contraction arhythmia and his blood-pressure is systolic 210, diastolic 150. Signs of an early tabes exist, the pupils are very sluggish to light, the ankle-jerks are absent, and he has a slight Romberg. The urine contains albumin and casts, the renal function with the phthalein test being 60 per cent. The clinical diagnosis in this man's case was syphilitic myocarditis, nephritis, and tabes. The roentgenogram (Fig. 230) shows a typical aortic type of heart with a diffuse dilatation of the aorta. I am sorry we have not the spinal fluid findings in this case. It is not improbable that we would find the Wassermann positive in the spinal fluid. I have no doubt in my mind that the organic conditions here are all of syphilitic origin, and I am particularly glad to show you this case because it represents a not infrequent experience of encountering late syphilitic develop-

ments, such as tabes, aortitis, and myocardial disturbance, in an individual who has a negative blood Wassermann. We are not to pin our faith too absolutely to the findings of the Wassermann reaction; there is a margin of error quite wide enough (40 per cent.) to lead us astray if we dismiss the idea of syphilis on a negative laboratory report. Experienced clinicians will not make this mistake, and we should all be a little more tenacious than we are in upholding our clinical diagnosis when we find it opposed by the laboratory reports. After all is said and done, there is no

Fig. 230.

criterion in medicine more reliable for diagnosis than the information secured by careful clinical history and painstaking physical examination. One or two points in this case may delay us profitably. The peculiar lassitude and depression which constitutes the chief complaint of this patient is a symptom occasionally noted in aortitis, and is interpreted by Albutt as significant of coronary involvement. Another point of interest to be noted is the association of aortic disease with signs of developing tabes. This is an association not infrequently noted in literature. In manifest tabes Stadler found aortic disease in almost all cases.

He regarded so-called cardiac crises as being, in reality, angina pectoris due to coronary stenosis. In this connection I show you the aorta of a patient who recently was in one of our wards (Fig. 231). He was picked up by the police ambulance and brought to the hospital. He had been seized while on the street with a severe pain in his chest and had fallen to the pavement. When he was admitted he was manifestly in severe pain, was extremely pale, and distressed in appearance. The pain was referred to the chest, was described as an iron-like constriction, and he breathed

Fig. 231.

with difficulty. Nitrites failed to give him relief and morphin was administered, but it was not until after twelve hours had elapsed that he was again comfortable. This was not the first attack of that character that the patient had had, but was the most severe; it usually lasted several hours, was not induced by exertion, and was not accompanied by vomiting. Upon examination, he was found to have an enlarged heart, a practically normal blood-pressure, a wide aorta, and the characteristic signs and spinal fluid of tabes dorsalis. We experienced some difficulty in deciding whether the attacks of pain were genuine angina

pectoris or cardiac crisis of tabes, but decided in favor of the latter after having kept him in the hospital for a number of weeks without any recurrence of pain, although he was permitted to indulge in very considerable activities. I need not emphasize the difficulty that must necessarily surround the decision, especially between attacks, of this point. History of the case and the stage to which the tabes has developed will prove important factors in the proper evaluation of the cardiac pain. In general, with well-advanced tabes, anginoid symptoms are more apt to be

Fig. 232.

cardiac crises. With tabes latent and the aortic disease well developed anginal seizures will more probably prove of true cardiac nature. In general, the symptoms of aortic disease appear later than tabetic manifestations. This is, perhaps, not because aortitis is a later development, but only that it has a longer latency than tabes.

I cannot refrain from citing a case recently observed in private practice, especially as I have Roentgen plates for your inspection. The patient was a white man, aged thirty-two, married, with two children, one of them living and healthy. He de-

nied ever having had a syphilitic infection and had always enjoyed the best of health. He had been active and robust until three months before he came under my observation, when, following exertion, he developed dyspnea, cough, and palpitation. Seeking professional advice, he was told that he had a heart disease, although its nature was not suspected. Upon examination, his heart was found very much enlarged, there was present the diastolic murmur of aortic insufficiency, his blood-pressure being 200 systolic and diastolic 80; the blood Wassermann typically positive. The roentgenogram, as you will see (Fig. 232), shows a heart shadow increased in both length and breadth; the shadow of the aorta is much widened and rises high in the chest. The second plate, taken in the anterior semilateral position, shows beautifully this great thickening of the heart and increased aortic width. I refer to this case not because it is an essentially rare one, but because it represents an observation we may any of us encounter in clinical work at any time. Except in the item of the man's ignorance of his lues it differs in no way from any individual who develops aortic insufficiency in adult life without antecedent endocarditis. Experienced clinicians know very well the nature of these cases of aortic insufficiency developing in the adult, but to many it will require emphasis. Every individual displaying aortic lesions who does not give a clear history of rheumatic endocarditis should be at once suspected, whether he avows it or not, of having syphilis, and a Wassermann should forthwith be made.

I shall conclude this series by presenting to you the case of R. W. to illustrate the difficulties sometimes encountered in the diagnosis of aneurysm resulting from syphilitic aortic involvement. This patient, thirty-four years of age, entered the hospital for relief from a severe paroxysmal cough. The cough had a suspicious strident, unproductive character, was worse at night, interfering with sleep, and there was a good deal of hoarseness. The cough was little influenced by exertion, but decidedly aggravated by the recumbent position. His general health was excellent. He confessed to having a syphilitic infection ten years ago. Aneurysm of the aorta was suspected; indeed, it was the "exam-

ining-room diagnosis" based upon the character of the cough, but not supported by any convincing physical signs. All that physical examination revealed was an obscure systolic murmur at the inner edge of the left scapula just above the inferior angle. The heart and chest were otherwise negative; no physical signs of aneurysm could be detected except that the laryngoscopic examination showed left vocal chord paresis. The blood Wassermann was strongly positive. When we came to examine this man's chest with the *x*-ray we were greatly disappointed not to find anything to support our diagnosis. A number of plates showed

Fig. 233.

absolutely nothing; the heart was normal in size and contour. Finally, upon subsequent examination, we got a good plate of the aorta in the semilateral position (Fig. 233) which decided the matter beyond question. You will see by this plate that there exists a well-marked aneurysmal dilatation of the posterior aspect of the transverse portion of the aortic arch. Its position furnishes the key to the pressure cough which plagues this patient and renders easy of understanding why recumbency so greatly aggravates his discomfort. An aneurysmal bulging of this size might exist almost anywhere else without causing any symptoms,

indeed, we know that not only small bulgings but saccular aneurysms of large size may develop without the patient having any symptoms whatsoever, constituting the so-called "aneurysm without symptoms." An aneurysm placed as this one unfortunately is need not be of large size to produce the most disturbing symptoms, somewhat in the same manner as a small retrosternal goiter pressing upon the trachea may make life miserable, whereas a large mediastinal growth exerting lateral pressure may hardly publish its existence.

Fig. 234.

If you will for a moment inspect the last of this series of plates (Fig. 234) you will see a large aneurysm of the transverse portion of the arch extending, as such bulgings usually do, to the left, so that the aneurysm in this case fills a considerable portion of the dome of the chest. The patient who has this aneurysm entered the wards for diagnosis. Being an intelligent man, he had become skeptical of the existence of a chronic tuberculosis which had been diagnosed in his case, and for which he had been treated for six months in a tuberculosis sanitarium. For almost a year he has had a cough, with a moderately copious catarrhal expectoration.

Beyond this single symptom there had been no complaint except to note a gradual loss of flesh. An aneurysm apparently had not been suspected. An *x*-ray had never been made of the chest. Physical examination revealed a dull area corresponding to the shadow shown on the plate, with many moist râles throughout the left chest. The mass when observed on the screen was seen to pulsate with a distinct expansile pulsation. Quite recently, through the courtesy of a friend of mine, I saw the chest plate of a patient who had an enormous aneurysm of the first part of the arch which filled entirely the area ordinarily occupied by the upper lobe of the right lung, causing its complete collapse. I was assured that this state of affairs had given rise to no symptoms whatsoever referable to the chest, and had been discovered quite accidentally while screening the patient during the course of a routine gastro-intestinal fluoroscopy. Direction in which pressure is exerted by the aneurysm and the rapidity with which the dilatation occurs and grows are undoubtedly determining factors in the production or absence of symptoms.

In our discussion this morning we have reviewed in a somewhat desultory way certain of the important considerations in connection with syphilis of the aorta. Many points of necessity have not been touched upon. I have sought rather to bring out the leading clinical features. My desire is to particularly impress upon you the importance of the aortic manifestations in chronic syphilis. The character of the material one handles undoubtedly plays a considerable part in cultivating interest in this feature of syphilis. In large urban centers with a considerable proportion of negroes in the population aortic syphilis will have a much greater incidence and come more frequently under observation than in less congested areas with a population of less mixed type. The colored race, perhaps because of some undue susceptibility of vascular tissue and probably also to some extent because of carelessness in their attitude toward treatment, when they acquire syphilis, which they do as is well known very frequently, furnishes us a larger proportion of syphilitic aortic degenerations than any other class. Lenz makes the statement that in large cities 25 per cent. of all syphilitics die from aortitis and its conse-

quences, as against 3 to 4 per cent. from paresis, 1 to 2 per cent. from tabes, and 10 per cent. from all other forms of internal syphilis, as of the brain, liver, stomach, lungs, etc. Living in Hamburg, where there is a large sea-going working population, a class proverbially exposed to conditions favoring aortic disease —*i. e.*, syphilis, hardship, hard work—Lenz's statistics may perhaps not serve as a fair criterion for other communities. But, after discount, his statement will serve to emphasize its importance in any industrial center.

Aortic syphilis presents us with a double problem in treatment. Every case that has advanced to the stage of clinical manifestation is a cardiopath, and requires to be safeguarded according to the well-known rules which constitute the hygiene of that class. The special feature of its therapy which interests us today is the treatment of the specific underlying factor. Aortitis is due to localization in the aortic tunics by the spirochete of syphilis, and its progression, with the subsequent developments which mark its course, are the results of the activity of that organism. If we accept this very obvious conclusion, the equally obvious deduction is apparent that we must treat syphilis in the aorta as we would syphilis in the skin or in the nervous system by direct attack with intensive antisyphilitic therapy. If we hope for cure by this method, disappointment invariably awaits us, for the simple reason that aortitis advanced to clinical recognition has wrought serious damage to the parts involved. Aneurysms, scars, dilatations, deformities cannot be cured, but a carefully planned campaign against the spirochete may suffice to control the future progression of the disease and protect the tissues from further damage. As I have indicated by several citations, antisyphilitic treatment is capable of greatly improving the symptomatic comfort of these patients, and even were this all of which it were capable, its guarded yet vigorous employment would be justified.

CLINIC OF DR. JOSEPH C. FRIEDMAN

MICHAEL REESE HOSPITAL

REFLEX GASTRIC DISTURBANCE AND EPIGASTRIC PAIN

Pylorospasm: Meaning of Tenderness in Epigastrium. Origin of Pain in Some Cases of Angina Pectoris.

THE patient whom I wish to demonstrate is forty-one years of age, single, a drug clerk by occupation, and complains of pain in the epigastrium and left side of the abdomen, extending around to the back. It is a burning pain, rather sharp in character, and comes on two to three hours after eating. It is worse just before meals. He has complained of this about ten years rather constantly. He first noticed constipation; then some distress after meals, and more recently the burning sensation above mentioned. He has never had any night pains. All his symptoms have been somewhat exaggerated in the last two weeks, during which time he has lost 5 pounds. The patient's previous history is unimportant except for an appendectomy thirteen years ago.

On examination we see a rather poorly built man in a fair state of nutrition, with a marked kyphoscoliosis of the dorsal region and an equally marked, evidently compensatory, lordosis in the lumbar region. This deformity has been present since childhood and has never given him any trouble. It is evidently due to some general disturbance in this patient, such as rickets, rather than to a spondylitis. The lungs and heart are normal and the abdomen somewhat protuberant. The abdominal walls are rather thin and musculature slightly developed. The spleen and liver are not palpable. There is no abnormal tenderness anywhere in the abdomen. Reflexes are normal. Blood, urine, and temperature are normal. Rectal examination shows a small amount of fecal matter in the ampulla.

As a result, then, of our examination we can only say that our patient has a rectal constipation or a so-called dyschezia. Is this sufficient explanation for the pain? A pain of this sort, coming on more than one hour after eating and being relieved by the next meal, is, as I have frequently pointed out to you, a type of late pain, and, in my experience, indicates just one thing, namely, pylorospasm. The method by which pylorospasm produces pain is known to you. We believe, in short, that the sensory nerves of the gastro-intestinal tract do not respond to the same kind of painful stimuli as the sensory nerves of the skin. The specific pain stimulus of the afferent nerves of the stomach and intestines is an abnormal increase in intragastric or intraintestinal pressure. Such an increase would be brought about by a contraction of one section of a viscus without the normal relaxation of the segment distal to it. For instance, contraction of the antrum of the stomach without relaxation of the pylorus would cause an increase in pressure in the intervening segment. This increase in pressure is felt as a pain. Such a condition is more apt to arise toward the end of digestion when the pylorus normally tends to close, or when the stomach is entirely empty, and hence the pains of pylorospasm are more apt to occur at this rather than at the beginning of a meal, when the pylorus tends to relax.

The most frequent cause of such late pains is, by all odds, an ulcer situated at or near the pylorus, but it would certainly be an exaggeration to state that this is the only cause, for it is most reasonable to believe that any condition which stimulates the vagus may give rise to pylorospasm, hence, to typical late pain. Such are simple hyperacidity or hypersecretion, adhesions between the gall-bladder and the pylorus, or overirritability of the vagus due to hyperesthesia of the central nervous system, and in some cases a late pain is connected in some way with constipation, probably both being due to an abnormally irritable central nervous system.

With this explanation of visceral pain in mind, let us return to the laboratory examination and our *x*-ray findings. A test-meal was given and withdrawn in portions at intervals of one-

half hour for three hours, showing a maximum free acidity of 20 and a maximum total acidity of 36, with some slight impairment of motility. There was no blood in either the stomach contents or stool. Further examination of the stools showed no increase in mucus, starch, fat, or meat fibers.

The *x*-ray report is as follows: The stomach is hypotonic, the greater curvature coming down to within four fingerbreadths

Fig. 235.—Arrow indicates bulging on greater curvature. Taken forty minutes after ingestion of barium.

of the symphysis. Peristalsis is normal, the waves starting high up on both curvatures. The antrum cuts off well; there are no gastric defects. The bulbus duodeni fills readily, is regular in outline, and freely movable. At one point on the greater curvature in the cardiac portion of the stomach about one-third of the distance between the lowest point and the cardiac orifice is a bulging which changes with the respiratory rhythm, being

most marked during the expiratory phase and disappearing during inspiration. It is quite independent of the peristaltic waves, and gives the impression that this point is being held down when the stomach rises during expiration, the pull being relaxed during inspiration (Fig. 235). In six hours the stomach was empty. The barium column has reached the terminal ileum

Fig. 236.—Barium per rectum and by mouth, showing relation of bulging on stomach wall to colon.

and is collected in the pelvic ileum. In twenty-four hours it has reached the rectum. The colon appears movable throughout, but the cecum is not well filled at this time. The descending and sigmoid colon show now only as a narrow ribbon. The splenic flexure is low as well as the hepatic flexure; the former when the patient is upright being below the crest of the ilium.

A barium enema was given, the patient was again given barium by mouth, and it was then seen that the prominence on the greater curvature was due to a pull on the stomach by the splenic flexure, the latter being, as stated above, abnormally low in the abdomen, but not abnormally fixed (Fig. 236).

The result of the *x*-ray examination, then, is a very marked visceroptosis, with a marked dropping of the splenic flexure as well as the hepatic. The latter condition, namely, the dropping of the hepatic, being quite frequent; the former, namely, the low position of the splenic, being somewhat unusual, due, of course, to a relaxation of the phrenicocolic ligament, with no corresponding relaxation at the left gastrocolic omentum, resulting, at each respiratory phase, in a pull on the greater curvature of the stomach, and hence causing the prominence above mentioned. Can this cause a gastric disturbance? I would not have placed much stress on the possibility had I not, a few months before, seen an exactly similar occurrence with similar symptoms, and this case I wish to report to you somewhat in detail.

The patient is a young married woman who has been complaining for five years of considerable abdominal distress. This consists of a feeling of fulness in the abdomen, relieved by soda, and also relieved by passing flatus. She has no real pain, but sometimes has a heart-burn one to two hours after eating. She has no night pains, and during this same period of time has had a constipation gradually increasing in intensity. Seven years before she had had a left nephrectomy for pyelitis. On looking up the operation, it was found that the left kidney was adherent to the colon, and that during the operation the colon had to be peeled off from the kidney for a considerable distance. Her appetite is good, she has lost no weight, and except when she has the abdominal distress feels perfectly well. The physical examination is negative. The stools reveal nothing abnormal. The stomach contents show a maximum total acidity of 72, maximum free of 42, with good motility. The *x*-ray report is as follows:

The stomach is hypotonic, the greater curvature being three fingerbreadths below the crest of the ilium. Peristalsis normal, antrum cuts off well, bulbus duodeni fills well, is sharp and clear

in outline and movable. On the greater curvature, at a point about two fingerbreadths below the indentation of the left costal arch, is a bulb or pouch which is quite independent of the peristaltic waves and which increases on expiration as the diaphragm rises, and decreases during inspiration with the descent of the diaphragm (Fig. 237). This pouch suggests adhesions of the

Fig. 237.—Mrs. S. Arrow points to bulging on greater curvature. Fluoroscopically it was more marked than this plate indicates.

stomach at this point, pulling the stomach out, rather than a filling defect. In six hours the stomach was empty. The barium had reached the ascending colon. In twenty-four hours the barium had reached the rectum, the ampulla containing a very large amount. The hepatic flexure is low; the splenic flexure is in the normal position. In the ascending loop of the splenic flexure is an area of constriction due either to spasm or to ad-

hesions connecting with the pouch on the greater curvature of the stomach. The cecum is somewhat immobile. In forty-eight hours the colon presents the same picture at this time as at twenty-four hours, with the exception that there is less barium present. An opaque enema was given two days later after the bowels had been emptied from the barium meal. The colon then

Fig. 238.—Barium enema with barium in stomach, showing adhesions between the two.

filled readily throughout, revealing no defect. Some barium was given by mouth at this time, and it was then apparent that the ascending loop of the splenic flexure is in close relation to the stomach, especially at the point of defect which presents itself on the greater curvature as in the first examination. It is impossible to separate the stomach and colon at this point, as they are apparently firmly united (Fig. 238).

To sum up our findings then: We have a patient who, a few months following a nephrectomy, seems to have abdominal distress and an increasing constipation, with a late pain or, rather, a heart-burn. Our clinical findings are hyperacidity. Our radiographic findings are adhesions between the splenic flexure and the greater curvature of the stomach, with some spastic condition of the former and an intermittent pull on the latter. My explanation of the constipation would be that it is of a spastic type resulting from some stimulation of her colon and causing a collection of gas at the point of spasm, also interfering intermittently with the onward movement of the fecal column. The adhesion to the stomach results in an irritation of the vagus and a consequent hyperacidity, and also in the pylorospasm, and I believe that exactly the same interpretation can be given to the findings of the patient I am presenting to you, the difference being that the abnormal pull is due to a descent of the splenic flexure instead of being the result of an old inflammatory process.

There are, however, several points in the history which need further discussion. The first is the meaning of abdominal and, in particular, of gastric distress. Our interpretation here depends on the time at which the distress appears. It is, as you know, a most frequent complaint in visceroptosis, and characterized here for the most part by its occurrence immediately on taking food. Here, as usual, the abnormal sensation must be interpreted in terms of abnormal intragastric or intra-intestinal pressure. The most reasonable theory is that in the normal individual as food enters the stomach the muscle-fibers relax in order to accommodate the increase in contents. In the lower animals we know that this relaxation may amount to three times their tonic length. In a visceroptotic and atonic stomach this relaxation, however, is constantly present; therefore, when food is introduced, no further relaxation can occur. Consequently, the individual gets the sensation of an already filled stomach, that is, a sensation of fulness, and the desire for further food is lost. If the feeling of fulness occurs one or more hours after eating, it has exactly the same meaning as a pain in the epigastrium or as heart-

burn; that is, it is due to a rise in pressure, generally in the antrum, and, as stated above, is caused by abnormal closure or absence of relaxation of the pylorus; in other words, a pylorospasm.

Pylorospasm, then, may result in all grades of discomfort, from a slight feeling of fulness to a heart-burn, or to an intense pain, the degree of discomfort evidently depending on the varying increase of intragastric pressure. It must be remembered, however, that in the three to six hours following a meal the food is passing through the small intestine, and a spasm resulting in a local increase in pressure may arise consequently in any part of the small intestine during this time, and hence we may get a typical late pain through the spasm if there is a lesion in any part of the small intestine, so that all late pains are not necessarily due to lesions in the stomach, but may just as well be due to lesions in other parts of the intestinal tract at the time of their greatest activity. For instance, I remember one patient who had an intense pain in the pelvis one hour after eating, and at operation a massive adhesion between the omentum and the pelvic ileum was found as the result of an old pelvic peritonitis. Here, evidently, the peristalsis of the stomach exerted a pull on the ileum through the omentum, causing irregular contractions and, consequently, quite severe pain. The patient was and is still relieved by the operation.

Intestinal distention, then, may result in all grades of discomfort, from a slight distention to the most severe colic. What is it that determines the degree in any given individual? Unquestionably the most extreme grade of increased pressure or spasms will be interpreted as pain by all individuals, but in the milder grades unquestionably a great deal depends on the sensitiveness of the nervous system of the patient, and what is a simple distress in a phlegmatic individual will be interpreted as a severe pain in a hyperesthetic or so-called neurasthenic individual, that is, one with an unstable sympathetic system. A good example of this is the condition so often seen in the involution psychoses. A common complaint here is of a pain or discomfort which feels as though it were traveling around from one part of the abdomen to the other. In such an individual whom I re-

cently fluoroscoped the cause of the discomfort was evident. There was very marked hyperperistalsis of the stomach and the whole of the small and large intestine, so that within thirty minutes the whole of the small intestine and the large intestine to the hepatic flexure were filled with the barium meal. It was this unusual distention which caused the patient discomfort.

Such a condition is not unusual after gastro-enterostomy, but whereas in those conditions the patient complains simply of a feeling of fulness after eating, in the psychasthenic individual the feeling of fulness was interpreted as unbearable distress. We must, then, in interpreting the severity of this condition always consider the nervous reaction of the individual.

Another point in the history of our patient is the increasing constipation. You will remember that the *x*-ray report tells us that the barium was in the rectum in twenty-four hours after ingestion; that at that time the descending colon and sigmoid were spastic in their turn, showing only as a narrow ribbon. The perfectly normal onward movement of the barium column is the usual finding in a patient of this type. As you know, the average time for the barium to reach the cecum is four and a half hours; the hepatic flexure, six and a half hours; splenic flexure, nine hours; the pelvic colon, eighteen hours, and the rectum, of course, within twenty-four hours. The delay, then, must be in the final act of defecation, and this, as I said above, is the rule in visceroptotic individuals. Constipation in such individuals is not due to kinks and twists at the flexures, as Lane and so many others believe, but is simply due to an inability of the abdominal muscles to play their part in the final act. It is, then, not a colon constipation, but a rectal constipation or so-called dyschezia. The futility, then, of attempting to overcome the result of this type of sluggishness by excluding the colon is obvious. Other means must be used. The ribbon-like sigmoid is a frequent complement of this condition. Unquestionably, it is generally due to a reflexly irritated bowel either from the constant presence of stool in the ampulla or from an overirritable central nervous system. I think in the present case it is fair to believe that some of the spasticity at least may be due to the unusual pull from

the stomach, just as we interpreted the gastric spasm as partly due to the unusual pull from the colon.

With these facts in mind the treatment is simple. We shall try to place the colon in a more favorable condition in order to relax the pull of the stomach wall. A properly fitted binder with a pad in the left lower quadrant placed in position while the patient is reclining with hips elevated is the first necessity. The second is a strengthening of the abdominal muscles by appropriate exercises, such as lifting the body from the reclining to the upright position by the trunk muscles alone; lifting the legs from the reclining position to the upright, bending forward and backward, etc., are of very great assistance. Massage is not indicated here, because we already have a spastic colon and manipulation would only increase this condition. The diet should have two considerations: first, the atonic stomach, and second, the spastic colon. The atonic stomach requires us not to overload it at any time. Meals should, therefore, be concentrated and dry, fluids to be taken between meals only. All foods should be very thoroughly cooked and soft. All mechanical irritants, such as cellulose, should be reduced to a minimum. No further attention need be paid to any balance of the different constituents except the instinct or the desires of the individual. It must always be borne in mind that the condition of the central nervous system has an important bearing on the functioning of the gastro-intestinal tract, and these conditions may remain latent until called forth by some unusual mental strain.

For the actual relief of the constipation cathartics are contraindicated. There is only one exception or partial exception, and that is milk of magnesia when the patient has a hyperacidity; then such a mild cathartic which neutralizes the acidity is not contraindicated. Strong ones, by increasing peristalsis, only make matters worse. The best treatment, unquestionably, is the old one of oil enemas of 4 to 6 ounces, to be retained throughout the night; then gradually leaving out two or three nights a week until only an occasional one is necessary.

The patient with the nephrectomy under such treatment has remained well with an occasional relapse since the beginning of

treatment. If necessary, we may give belladonna and bromids for a short time to further diminish spasm. They must, of course, be given to the physiologic limits in order to produce any results.

It is my firm conviction that operative procedure is indicated in adhesions only when the necessity is unusually urgent; continuous vomiting, for instance, or a constipation bordering on obstruction might drive us to such interference, but certainly when we know that the separation of adhesions is likely to be followed in a few months by the formation of still firmer ones, we should exhaust all our other resources before taking refuge in surgery.

CASE NUMBER TWO

The second patient has some points of similarity with the preceding one, as well as some striking differences. He is sixty-nine years old, married, and has been a very active man all his life. He complains of pain in the epigastrium, discomfort in the same situation, belching and loss of weight, the latter amounting to 82 pounds in five years. He has had his pains in the epigastrium for several years. They extend upward under the sternum and backward between the scapulæ. They come on one to two hours after meals, often accompanied by nausea, but never by vomiting. At times he is awakened at night with the pain. Almost always after eating he has a sense of discomfort in the stomach almost immediately, which he describes as a tightness or a sense of constriction. The pains are made worse by walking, but are not particularly relieved by lying down. There is marked relief by belching and by taking some warm fluid. They last from twenty minutes to three hours. His appetite is good, but he is afraid to eat. He has discarded various articles of diet, such as cereals, many other carbohydrates, meat, as he believes that they may be responsible for his pains. As a consequence he has been living on broths and milk and a few soft foods for some time.

Past History.—He had pneumonia twenty-six years ago, typhoid forty-eight years ago. Forty-five years ago he had a severe diarrhea with mucus in the stools lasting for about a month. He has been a heavy smoker, but a very moderate user of alco-

hol. The last four or five years small amounts of sugar have been found in his urine at times. He has coughed, especially in the morning, for many years, and at such times has expectorated freely, but never any blood. Denies all venereal infection.

On examination, we see a well-built, somewhat emaciated man, whose lips are slightly bluish, whose tongue is quite dry and red. His pulse is full (96), regular. Arteries show no marked thickening. Lungs are normal. The heart outlines are normal, sounds are quite weak, no accentuations, no murmurs. Blood-pressure 145 systolic, 65 diastolic. The abdominal skin is very loose, with a lack of subcutaneous fat. No abnormal peristalsis. No tumors. There is some tenderness in the mid-epigastrium and over the xiphoid. There is no rigidity. The tenderness is not a skin hyperesthesia, but obtained only on deep pressure. Some succussion found extending to two fingerbreadths below the umbilicus. Elsewhere no tenderness. Spleen, liver, and kidneys are not palpable. The reflexes are normal and there is no edema in the extremities. Sputum examination: No tubercle bacilli found. Stool somewhat constipated, dark. Benzidin test positive. Guaiac negative for blood. No increase in mucus. There was some increase in starch granules. No test-meal was given because of his weakness. A blood Wassermann was negative. Urine on entrance 1024 specific gravity, a trace of albumin, and an occasional hyaline cast. No sugar. Blood examination normal.

To sum up the history and the findings as thus far given: There is a pain in the epigastrium definitely related to the taking of food, consisting of a distress immediately after eating, and also a severe pain one to two hours after eating, especially after he has exerted himself. Then, sometimes, a pain awakening him at night, relieved by belching or by passing gas. There is marked tenderness in the epigastrium and over the xiphoid, the whole suggestive of some gastric disturbance. This has lasted many years and his appetite has remained good. This is apparently not a very malignant process, possibly an ulcer. The unusual facts are: first, that it has been rather continuous during this time; second, that it is worse on exertion; third,

that it radiates up under the sternum. All of these things may, of course, occur with complicated ulcer. An ulcer which has invaded the peritoneum can cause some perigastritis. It may give a continuous distress or continuous pain instead of an intermittent one. An adherent ulcer, adherent to the surrounding viscera or to the abdominal wall, may cause a pain which is worse on exertion, and finally adhesions to the small intestine or to the gall-bladder may cause a pain which radiates up to the sternum. The cyanosis is very slight, the heart apparently normal, but yet when we have a pain even in the epigastrium which is worse on exertion the heart must be taken into account. A negative physical examination has no significance, as myocarditis, for instance, may be of the most extreme grade, with no enlargement, no murmurs, and no other objective findings, all changes being indicated by functional variations, indicating a limitation of the reserve power of the heart, such as dyspnea on exertion; even the electrocardiograph fails us here.

Before we proceed further it is necessary to consider the meaning of tenderness in the epigastrium. It was formerly believed that tenderness on pressure in this region, especially if limited in area, was very suggestive, if not strictly indicative, of ulcer of the stomach; that is, that such an ulcer was itself sensitive, and that by pressure one could localize the ulcer exactly. Speaking of pain, I pointed out that pain in ulcer was not due to soreness of the raw surface, but that ulcer pains, like pains elsewhere in the gastro-intestinal tract, were due to changes in pressure in the viscera resulting from abnormal peristalsis. One consequence of this might be that the pain could be in the same place, no matter in what part of the stomach the ulcer was situated. Doubt was thrown on the statement that the pain was within the stomach at all by the fact that, in stomachs which were completely dislocated, for instance, in visceroptosis, the pain and tenderness were still felt in the epigastrium. In investigating this inconsistency Raux found that the point of tenderness in ulcer cases and many other stomach cases was directly over the solar plexus, and he believed that the tenderness elicited on deep pressure was the result of pressure not on the ulcer nor even on the stomach,

but on the solar plexus. This interpretation is now discredited, however, as these sympathetic plexuses in other parts of the body are apparently not tender, and there is no reason to believe that nerves because they happen to be transmitting painful sensations should themselves be tender. It is now believed that the tenderness elicited on deep pressure is not within the abdomen at all, but is in the wall of the abdomen, in the skin, muscle, and subperitoneal tissue; that is, in the region of peripheral distribution of cerebrospinal nerves.

The theory is that a painful sensation such as that produced by an increase in intragastric pressure is transmitted probably along the sympathetic nerves to the spinal segment to which these nerves run. These unusual and painful sensations spread to the ending of the cerebrospinal nerve in the same segment, and are by them transmitted to the brain, which then refers the painful sensation to the place from which these sensations most frequently spring, that is, from the abdominal wall and not from the place where they did spring in this particular instance, that is, from the stomach. Such a reaction would have value to the individual. Pain is necessary in order to protect the individual from harm. The stomach has no voluntary protective mechanism, but in the periphery of the body the abdominal walls and the extremities of course have many means of protection, and the reference of pain to them would result in the use of one of these; for instance, stiffening the muscles or using them in other ways. However that may be, the point remains that so far as can be determined by operation, either with local anesthesia or with no anesthetic at all, serious lesions of the gastro-intestinal tract are apparently not sensitive to ordinary painful stimuli, such as burning, pinching, cutting, etc., and that some other explanation must be found for their *apparent* pain-producing powers.

It will be objected that even when no spontaneous pain is felt in the epigastrium of patients who have ulcers of the stomach tenderness may still be elicited on deep pressure. How can this be accounted for if the pain is simply a referred one to the abdominal wall? The explanation given is simple. When a sufficient number of unusual painful stimuli have passed along some sym-

pathetic branch to a certain segment of the cord, a chronic irritable focus is produced at that point of the cord, and the cerebrospinal nerve running from the periphery to that point are, therefore, placed in a state of hyperesthesia, and ordinary pressure on them is felt as pain. This local irritable focus is the explanation of the tenderness which remains after the spontaneous pain has subsided. The reason why it is so difficult to determine the origin of pain in the viscera is evident from this explanation. The sympathetic nerves arise from closely related segments in the cord, and consequently their pains are referred to closely related areas in the skin, and the tenderness is in closely related areas of the subcutaneous tissue. Hence the difficulty in separating them. For instance, the sympathetic nerves that supply the heart probably arise from the upper four dorsal segments; those supplying the stomach from the fifth, sixth, and seventh dorsal segments. The vagus, which also transmits afferent stimuli, extends to the cranial nerve-roots and the upper cervical segments. The liver and gall-bladder are supplied by nerves arising from the seventh to the ninth dorsal segments besides, of course, being innervated by the phrenic, which arises from the upper dorsal segments.

The cerebrospinal nerve supply of the upper epigastrium is from the fifth to the seventh dorsal segment. It is, therefore, easy to see how painful sensations originating in the stomach are almost invariably referred to this region, and how painful sensations arising from the liver and gall-bladder and transmitted to the segment below, and those arising from the heart and transmitted to the segment above, may, if they are violent enough, spread to the sixth and seventh segments and be referred to the region to which ordinarily the gastric sensations are referred.

It goes without saying that the muscular rigidity in uncomplicated gastric ulcer and a sense of constriction occurring so often in connection with heart pains is a muscular contraction or increase in muscle tone, a defense phenomenon which occurs in these referred pains in the same way as it would occur if the pain really was originating in the abdominal wall or in the chest wall, a so-called visceromotor reflex. We must always remember

in this connection that besides the pains referred to the segment of body covering immediately over the viscus, there may be pains referred to much more distant portions of the body, provided that part of the innervation of the viscus is connected with the spinal segment which supplies those portions of the body; for instance, pain in the stomach or, rather, a disturbance in the stomach is sometimes felt as pain in the neck, or in the jaw on the left side, of course, most frequently. This is probably due to the fact that the vagus carries sensory stimuli and proceeds partly from the lower cervical segment, from which also the skin of the neck is supplied. Heart pains are felt on the inner side of the arm and fingers because its sympathetic fibers arise partly from the lower cervical and upper dorsal nerve which supply the skin of the arm.

There is, however, one class of visceral pains which must be separated from the above, as they respond to a different law; that is, the class in which inflammation or growth, that is, malignancy, has extended beyond the limit of the viscus and involves by pressure cerebrospinal nerves in the neighborhood. The pain, then, is felt somewhere along the course of these nerves. For instance, in a carcinoma of the cardia which has extended backward so as to involve an intercostal nerve, the pain may be felt in the lower axillary region. The intercostal muscles here are rendered tense and hyperesthetic. The pain is worse on deep inspiration, and the whole picture resembles a pleurisy quite closely. Carcinomas of the cardia are very difficult of recognition, either from the history, clinical findings, laboratory findings, or the *x*-ray findings. Therefore it should always be thought of when no adequate explanation of the pains in the left lower axillary region can be found.

In the present case, while the history of gastric distress, eructations, and the presence of pain and tenderness in the epigastrium seem to point to a gastric origin, the fact that the pain was worse on exertion or apparently at times originated after exertion made a cardiac origin possible, and, as I have tried to explain, cardiac pain may perfectly well be referred to the epigastrium, especially if intense. The fact that it did not radiate down the arm is, of course, of no importance. We should simply say that

in the present instance it radiated to the *lower* dorsal segment rather than to the *upper* dorsal segment. Owing to the fear that it might be anginal in origin, we made no attempt to pass the stomach-tube, but did examine the gastro-intestinal tract with the *x*-ray.

Fig. 239.—Stomach pushed to right by distended splenic flexure. The curve of the latter is unusually broad, suggesting adhesions to diaphragm.

On fluoroscoping him, before giving him an opaque meal, we were astonished to find that the whole of the gastro-intestinal tract could be outlined clearly by means of the enormous amount of gas therein contained. The whole of the stomach and intestines could be thus easily seen. The cardia was greatly distended with gas, a most unusual condition outside of intestinal obstruction, which, of course, is not present here. When barium was

given the dilated cardia was still more evident, the pars media was pushed over to the right, apparently by the distended splenic flexure (Fig. 239). The duodenum was well filled, but somewhat immobile. The stomach emptied rapidly, the motility being three hours, by which time the barium was in the pelvic ileum. In six hours the barium was in the transverse colon and in twenty-four hours in the descending colon. The splenic flexure seemed

Fig. 240.—Upper arrow points to diaphragmatic adhesions; lower, to broad splenic flexure.

to take a wider bend than the usual acute angle. The lower left chest showed some adhesions, pulling up part of the left half of the diaphragm (Fig. 240). We interpreted this as a remnant of the pneumonia which the patient believes was on the left side. In short, except for the marked meteorism and the possible adhesions of the splenic flexure to the diaphragm, the gastro-intestinal tract was normal, not supplying us any grounds for the diagnosis of gastric ulcer or gastric carcinoma. We have left,

then, the only other possibility, namely, cardiac pains or angina pectoris, and this, I believe, to be the interpretation of this case.

The other doubtful point can be readily explained. The fact that the distress comes on after meals is, of course, a frequent complaint in cardiac weakness. The extra exertion to which the heart is subjected during digestion, possibly a direct pressure from a distended cardia, embarrasses the weakened heart, and may cause dyspnea in one case and cardiac pains in the next. Our patient divides his distress into two kinds: one, an immediate distress which he feels as a sense of constriction in the epigastrium however, not in the precordium. The explanation, however, is surely the same. It is a visceromotor reflex due to heightened tension of the muscles of the abdominal walls and the lower intercostal muscles. One or two hours later he feels the real anginal pain, only, as stated before, in the epigastrium and under the sternum rather than in the arm. The patient himself insists that his distress must be gastric in origin because he is immediately relieved by belching or by passing gas per rectum. This is an interesting point and we shall consider it a little in detail.

Gas in the intestinal tract may arise from two sources: first, from fermentation of carbohydrates and to a less extent from proteins, and, too, from swallowed air. The oxygen from the latter is mostly absorbed in the stomach, part of the nitrogen passing onward into the intestines. Unquestionably, the gas ordinarily found in the stomach is due to swallowed air, there being very little opportunity except in cases of extreme gastric stasis for fermentation. An excess of gas in the intestines may be due to excessive production or, second, to diminished absorption or diminished elimination. For instance, in the aged we may have both of the latter factors present. We may have a marked atrophy of the musculature resulting in a reduced peristalsis; hence a diminished elimination and a proved atrophy of the mucosa probably resulting in a diminished absorption. A combination of these three factors results not infrequently in a fluoroscopic picture such as was seen in the present instance. Here, I believe,

the factor of increased production was also present. It is a fact that in some cases of angina the end of the pain is attended by violent eructations or passage of flatus. The explanation of this phenomenon is that during the intense pain the patient remains quiet, with chest expanded, diaphragm raised, and glottis closed, the whole, of course, being quite involuntary. As a result of this, the pressure in the stomach is lowered and air rushes into the esophagus. The stomach becomes distended, and as soon as the most severe part of the pain is over, the patient eructates and obtains some relief therefrom, and considers that the pain must have been due to the presence of the gas in the stomach. Naturally, he attempts to belch still more, in the meantime unconsciously swallowing more air. The noise of eructation may be quite loud, the whole almost impressing one as an hysteric phenomenon, if it were not for the agony that is evident in the patient's face. It is easy to see how the eructations, coming on after a full meal and accompanied by pain in the epigastrium, lead one occasionally to think seriously of a primary gastric disturbance. While recognizing this factor in our patient, it was thought also that the presence of a slight excess of starch granules and cellulose in the stools might indicate a factor of increased production of gas through fermentation, and this was taken into consideration in the treatment.

In order to test the accuracy of our diagnosis the therapeutic test was applied. The patient was put in bed, a diet was given containing rather high protein and fat, with a minimum of cellulose and carbohydrates, and at the onset of distress $\frac{1}{100}$ gr. of nitroglycerin was given, repeated at ten-minute intervals for four or five doses. The effect was very striking and the attack stopped quite abruptly, most unusually so, according to the patient.

I do not wish to go into detail as to the etiology of angina pectoris. It is a disputed point at present, but I believe that the theory of muscular insufficiency answers clinically most satisfactorily. The theory of coronary sclerosis, or of aortitis plus coronary sclerosis, is not an explanation of all cases of angina, as numbers have been reported in which the necropsy showed no

sclerosis present. The similarity to intermittent claudication of the lower extremities, therefore of muscular exhaustion, is striking. This may result, first, from an insufficient blood-supply, that is to say, a coronary sclerosis, or, too, there may be a normal supply, but a weakened muscle. The result will be the same. The individual may get an attack whenever the muscle is overexerted. He may get an attack, but need not, as the presence or absence of pain evidently depends upon still another factor, perhaps the central nervous system, as it is a notorious fact that we may have the most severe sclerosis of the coronary arteries or the most severe myocarditis and still no angina, while it is not so well known but equally true that we may have severe anginas with mild anatomic lesions. The prognosis, therefore, depends upon various factors, and for this purpose we might perhaps divide anginas into several classes: first, those occurring in the young, under which we may include heart pains arising in an apparently healthy heart due to some acute heart strain, and second, those occurring in the hearts of rheumatics or other endocarditis cases of record.

Second, those occurring between the ages of forty and fifty years, which will include the heart lesions resulting from nephritis and hypertension, the luetic cases developing aortitis, the cases occurring in women at the menopause with slight myocarditis, and some presenile cases; and third, the senile cases.

In general, the prognosis is the most serious in the second class of cases, those developing between forty and fifty years, in which there is a progressive nephritis or hypertension or an intractable lues. The occasional anginas occurring in endocarditis of the young is, of course, very serious. The mildest cases are those which occur in boys who have subjected their hearts to a short period of violent strain, especially in competitive athletics. The following is an example:

A boy of fourteen had been complaining for about a week of a choking sensation in his throat and a pain in the precordium. He had no dyspnea on exertion. On examination his apex was diffuse, beyond the nipple line with some dulness under the sternum, a slight systolic murmur at the apex, and a markedly ac-

centuated second pulmonic. The pulse was regular, and 90. Examination otherwise negative. After a week's rest in bed the heart was in the normal position, the murmur disappeared, and the accentuation of the pulmonic was much less. Unquestionably a case of anginal pain due to training for some skating races which had recently taken place.

Equally favorable is the prognosis in women about the menopause, in whom a lifelong neurasthenia has been accentuated by the climacteric and perhaps by some temporary worry. It is not unusual in these cases to find a systolic blood-pressure of 180 or 190, some pain either in the precordium or limited to the left arm, but no dyspnea on exertion. The proper kind of rest in these cases causes the subjective symptoms to subside. The senile cases are, of course, the most numerous, and average somewhere between the above two classes. In considering their prognosis we must remember, first, that the severity of the case is not necessarily proportionate to the intensity of the pain, for here, as in all disease, the intensity of the pain is partially a function of the sensitiveness of the central nervous system, for in the mild menopause cases mentioned above we may have a very severe pain, with a good prognosis.

There are two ways of ascertaining the outlook in any case: one way is to determine the amount of maximum effort without pain. For instance, if a patient has a severe pain on walking after a full meal, but at other times can walk considerable distances without pain, the prognosis is far more favorable, of course, than if he is unable to walk at any time without pain; and second, we must often await the effect of treatment before deciding the outlook. Luetic cases have occasionally a very good prognosis and respond rapidly to treatment; at other times apparently the damage already done cannot be repaired. In general, it is not fair to the patient to alarm him unnecessarily by invariably giving a poor prognosis in every case of angina, as many of them live in comparative comfort and work reasonably hard for ten, fifteen, and twenty years after the onset of the pain, and in other cases the pain entirely disappears after a varying period.

As an example of the senile type I shall outline the treatment for our patient: First of all he was put at rest. He was not required to remain in bed the whole day, as it was felt that some danger of a hypostatic pneumonia existed, and he was therefore allowed to sit up in a chair one hour in the morning and one hour in the afternoon. This is, of course, the prime requisite in all treatment of angina, namely, rest for the exhausted muscle. As the pains came on after meals, an attempt was made to make the meals smaller and to avoid overloading the stomach mechanically by making them as dry as possible and also concentrated. No fluids at all were given during the meals. No butter was added to the bread. He was required to chew all food thoroughly. The meat was given scraped or chopped. As there was some increased starch in the stool, all the coarsest vegetables—namely, those containing 5 per cent. starch—were eliminated, and peas, carrots, potatoes, etc., were passed through a sieve. Buttermilk was given between meals; the evening meal was very small and was given early, with 5 ounces of warm water given at bedtime. He was given cascara in divided doses during the day, and as he had a tendency to collection of stool in the rectum, he was given 1 pint of warm water as an enema each morning. At the first sign of pain or even of constriction he was requested to call for nitroglycerin, which was administered in $\frac{1}{100}$-grain doses repeatedly until the pain ceased. Besides the nitroglycerin during the attacks he was given sodium nitrite three times a day in 5-grain doses. His smoking was cut down from a large number of cigars to two small cigars a day.

Two other drugs are sometimes of use, digitalis and the caffein group. Digitalis is at times apparently of benefit, but I have seen patients in whom it apparently did harm, probably by overstimulating the muscle. At any rate, it should be given in small doses and the patient carefully observed. Caffein, as citrate or as diuretin, is in general of greater value than digitalis, as in most patients with myocarditis whether they have angina or not. Whether it acts simply as a diuretic or relieves peripheral resistance, or directly effects the heart muscles is an open question.

The patient so far has improved remarkably, having now been free of pain for over a week, and the mildest sense of constriction which occurs at times is relieved by a single nitroglycerin tablet. The outlook, therefore, is fair for continued restricted activity. Knowing, however, that the intensity of the pain in this case must be due to considerable anatomic changes, and not to an oversensitive nervous system, we have warned the family that sudden exitus is not out of the question.

CLINIC OF DR. JULIUS H. HESS

COOK COUNTY HOSPITAL

TUBERCULIN SKIN REACTIONS IN DIAGNOSIS OF TUBERCULOSIS IN CHILDHOOD

CASE I.—This four-year-old boy was admitted August 23d with the history of cough, fever, loss of appetite, and general malaise of eight days' duration. The cough was not productive and he suffered from a moderate degree of dyspnea.

Past History.—Pneumonia two years ago, measles and pertussis eight months ago; has always been of delicate constitution.

His family history is negative.

Physical Findings.—Positive findings: Lessened expansion on right side of thorax, increased vocal and tactile fremitus over whole right chest, and dulness over upper and lower right lobes anteriorly and posteriorly and over middle lobe anteriorly. Distinct bronchial and tubular breathing, with bronchophony and pectoriloquy over right chest. Many crepitant and subcrepitant râles. Temperature 101.6° F., pulse 120, respirations 36.

Laboratory Findings.—Hb. 60 per cent., RBC 5,120,000, WBC 11,600, polymorphonuclear 71 per cent., small mononuclear 20 per cent., large mononuclear 9 per cent. Urine negative. Pirquet positive. Quantitative intradermal test positive with all four injections, quantity of tuberculin used 0.00005 mg., 0.0005 mg., 0.005 mg., and 0.05 mg. (Fig. 241).

Course.—The lung findings persisted with but slight changes until the end of the first week. At that time, the note over the right chest being flat, aspiration was done and about 500 mils. of clear fluid withdrawn. No organisms were found. The child improved gradually, temperature declining by degress to normal. At the end of the third week physical findings in the right lung

were as follows: Dulness present on the right side, from the level of the fourth rib downward. Few fine râles present, but no bronchial breathing. Breath sounds diminished posteriorly, absent laterally and anteriorly.

Roentgenogram.—The picture was taken ten days after admission or three days after pleural cavity was aspirated. There is first seen a spinal curvature to the left, with an increase in size of the left intercostal spaces, and a corresponding decrease in width of the right. The heart is not displaced. The arch of the aorta shows to the left of the spine. The dense shadow in the peribronchial glands suggests an old process followed by calcification of these glands. A distinct vertical line is seen on the right

Fig. 241.—Case I. Positive intradermal quantitative tuberculin test.

side. This is probably the line of separation between the compressed lung and the fluid in the pleural cavity. The shadows over the outer half of the right lung are denser than that of the left, probably because of compression and congestion. The small shadowy dots seen over the compressed portion of the right lung are due to enlargement of the bronchial lymph-glands. Heart outlines about normal (Fig. 242).

Subsequent History.—The child was discharged at the end of a few weeks with all findings improved; there, however, remained an area of marked dulness over the right lower lung posteriorly, and later roentgenograms showed increased hilus and peribronchial shadows, as well as an area of calcification in the right lower lobe.

This represents an advanced case of pulmonary tuberculosis with associated tubercular pleuritis in a child with sufficient antibody formation to cause a marked reaction to the old tuberculin

Fig. 242.—Case I. Pulmonary tuberculosis with pleuritic effusion on the right side.

when administered in performing a cutaneous and an intracutaneous test.

CASE II.—This seven-month-old infant gives a history dating back two and half weeks, when the child fell from a cart, striking his head. Two days following the injury he vomited repeatedly,

became restless, and drowsy. He continued in a stuporous condition for about one week, when he developed a series of convul-

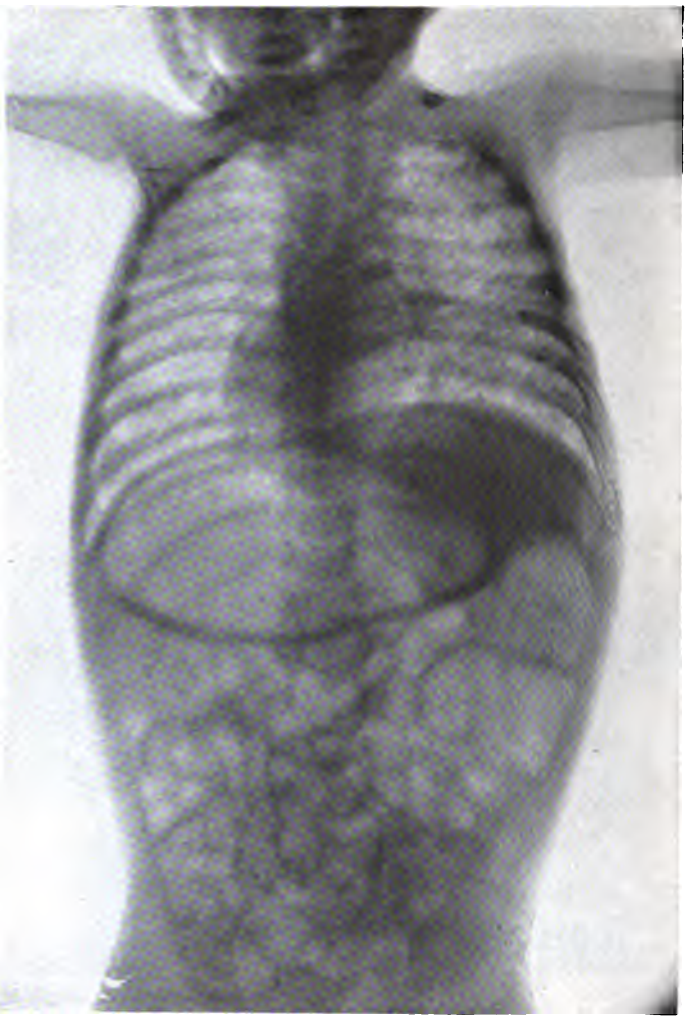


Fig. 243.—Case II. Typical mottling of generalized miliary tuberculosis in both lungs.

sions, followed by an internal strabismus and dysphagia. There is nothing important in his personal history other than that he was a bottle-fed baby since birth.

Family History.—His mother has an active pulmonary tuberculosis. His father and three other children are living and well.

Physical Findings on Admittance.—General appearance that of an apathetic, drowsy child with an internal strabismus, deep sunken eyes, and extreme pallor. Skin is dry, inactive, and shows numerous papulonecrotic tuberculids scattered over the body. Cervical glands are palpable. There is an internal strabismus which is most marked in the right eye. Neck: Brudzinski positive, otherwise negative. Thorax: Marked impairment of resonance associated with bronchial breathing and numerous râles heard throughout both lungs. Abdomen negative except that the liver was palpable two fingerbreadths below the costal arch. Nervous system: Babinski, Gordon, Oppenheim signs, all positive on both sides. Tache cérébrale very markedly positive.

Laboratory Reports.—Urine negative. Blood: Hb. 85 per cent., RBC 4,224,000, WBC 12,600, polymorphonuclears 62 per cent., small mononuclears 29 per cent., large mononuclears 7 per cent., transitional 2 per cent. Spinal fluid examination: Cell count 800, 96 per cent. lymphocytes; Noguchi, Ross Jones, and Nonne positive. Pellicle formation, but no micro-organisms found. Von Pirquet negative on three successive tests. Intracutaneous test of old tuberculin with four injections, the quantity of tuberculin used being 0.00005 mg., 0.0005 mg., 0.005 mg., and 0.05 mg., were all negative.

Roentgenogram showed the typical mottling of generalized miliary tuberculosis in both lungs (Fig. 243).

This case represents an advanced type of acute miliary tuberculosis associated with a tubercular meningitis, and a generalized bilateral lung involvement. In an infant so overwhelmed by the infection the cutaneous and intracutaneous tests remained negative even on repeated inoculations.

Subsequent History.—The child died six days later. At autopsy the roentgenograms were confirmed by the finding of generalized miliary tuberculosis (Fig. 244).

The positive value as well as the shortcomings of the various tuberculin reactions are well illustrated by the above cases. While a tentative diagnosis of tuberculosis could be made in Case I,

based on the presence of serous exudate in the pleural cavity following the development of acute pulmonary findings, the positive skin reactions were of definite value. In Case II, in which a positive diagnosis of acute miliary tuberculosis could be made from the spinal fluid and the roentgenogram, the skin reaction remained negative due to the overwhelming infection.

In the following we will, therefore, attempt a more careful study of the conditions necessary to positive skin reactions, dis-

Postero-anterior view through middle of lung. Postero-anterior view of posterior surface of lung.

Fig. 244.—Case II. General miliary tuberculosis and tuberculous meningitis. Shows primary lesion and secondary glands. Skin tuberculides.

cuss the history of the skin reactions, the nature of tuberculin reaction and its technic, describe the typical reaction and various types, the modification of original Pirquet technic, quantitative tuberculin tests, differential tuberculin tests, intracutaneous tuberculin test, subcutaneous test, the histopathology of tuberculin papule, inquire into the specificity of tuberculin skin reactions, define the meaning of positive and negative tuberculin skin reactions, and estimate its value in diagnosis and prognosis.

The skin is one of the tissues of the body which readily reacts to influences from within or without. There are two factors which are absolutely essential for the production of a skin reaction. There must be an agent capable of acting on the skin, and the skin, in turn, must be of sufficient vitality to be able to react to this agent. The ability of the skin to react is a matter of great importance. The character of the reaction produced is, however, dependent upon different conditions. The reactivity of the skin may be lowered with the lowered vitality of the body, as in markedly cachectic individuals, or it may be entirely absent in such cases. Newborn infants and infants in the first year of life frequently do not show any reactivity to certain noxæ, because the cells of the skin have not yet acquired the power of reaction (Moro[1]). In such instances the reaction is either very feeble or the skin is entirely unresponsive even to agents which otherwise are able to produce a reaction. A hypersensitiveness of the skin, on the other hand, may increase the reactivity to such an extent that an excessive reaction is produced to certain noxæ and even to agents that under normal conditions would be innocuous and ineffectual. This hypersensitiveness of the skin, which may be either "an inherited cutaneous irritability" or be present "in those of an active nervous temperament or in gouty and rheumatic subjects," is also regarded as an important etiologic factor in the production of the so-called eczematous skin reactions to agents which under normal conditions would provoke no reaction at all or a very mild reaction (Stellwagon,[2] Combe[3]). This may probably be an explanation of the results obtained by Schmidt[4] while investigating the action of different food substances applied to the skin in the same manner as the Pirquet test. His results showed a positive reaction in 40 per cent. of the cases, similar in character to the positive Pirquet reaction. The tests were made on 100 children suffering from different diseases, and it is interesting to note that the largest number of positive reactions was obtained in the cases of functional neuroses and arthritic diatheses, which corresponds to Stellwagon's observations on "those of active nervous temperament and gouty and rheumatic subjects." The reactivity of the skin is of great significance in test-

ing the specificity of the cutaneous tuberculin tests and also in interpreting positive and especially negative results. We shall have occasion to discuss it more fully later.

The character of the skin reaction varies from simple temporary hyperemia to structural changes, such as the production of papules, vesicles, pustules, etc. Structural changes of the skin generally result from excessive action of agents which when mild would produce but temporary hyperemia (excessive pressure, friction, excessive heat, overdoses or systemic accumulations of some drugs), or from the action of agents which in themselves are injurious to the skin or become injurious due to changes which have been produced in body fluids by previous existence of some disease.

Cutaneous reaction with formation of papule may be obtained by injection of chemical substances, complex poisons of bacterial origin, known as toxins, as those of diphtheria, typhoid, typhus, pyocyaneus, etc. (Entz[5]). All these toxins are primarily poisonous, that is, poisonous and injurious, therefore causing skin reaction in normal subjects. And yet in some cases no reaction may be obtained on injection of diphtheria toxin. This is explained by assuming that the toxin is destroyed by specific antibodies before it can act upon the skin and cause it to react in turn. It is this principle that has been made the basis of the Schick test. On the other hand, there are toxins that are only secondarily poisonous, that is, they are in themselves non-poisonous in normal individuals, but they become poisonous and capable of provoking skin reactions in individuals in whom some changes in the body fluids have taken place as the result of the previous existence of some diseases. Tuberculin, emulsion of Bacillus tuberculosis and their toxins are examples of this class (Hamburger[6]).

History.—The first man to call attention to skin reactions, as far as is known, was Edward Jenner,[7] who in 1798 described an "efflorescence" of a palish color at the site of injection of variolous material in a woman who had cowpox thirty-one years before. The next man to describe a skin reaction was Robert Koch,[8] who in 1898 showed that a single injection of living tubercle bacilli under the skin of the guinea-pig produced an ulcer, then

an infected gland, and finally a generalized tuberculosis, but that repeated injections produced a much more violent local reaction, ending in necrosis with an absence of the generalized infection.

In 1903 Arthus[9] described the local phenomenon of anaphylaxis in rabbits, as being manifested by redness, swelling, and wheal formation, and a local sloughing of tissues at the site of repeated hypodermic injections of horse-serum. This has been called the Arthus phenomenon of anaphylaxis, and is contrasted from the general anaphylactic reaction seen in its extreme form in a guinea-pig, and known as the Theobald Smith phenomenon.

Skin reactions as a diagnostic measure, however, have first been described by von Pirquet in 1908,[10] who made use of Koch's tuberculin by applying it on the skin and abrading the skin with a scarifier made for that purpose. He was followed by other men who used different methods, but applied the same principle for the diagnosis of tuberculosis (Calmette, Mantoux, Wolf-Eisner, and Moro).

The tuberculin skin reaction was followed by other skin reactions applied for the diagnosis of other diseases. In 1908 Schick[11] described a cutaneous reaction for diphtheria. In 1911 Noguchi[12] described a cutaneous reaction in syphilis. In 1912 Irons and Nicols[13] described a skin reaction for gonococcus infection, and in the same year Schloss[14] described an anaphylactic food reaction, especially one due to egg albumen. The above-named reactions have been standardized and used extensively for diagnostic purposes. In addition to the above, numerous other skin reactions have been described; for instance, a reaction for strepthothrix, for typhoid, for varicella, and for hay-fever, and other articles used as foods. The latter, however, have not been standardized as yet and their specificity is still in doubt.

The most widely used skin reaction is, beyond doubt, the tuberculin reaction, of which the Pirquet method is the one most frequently employed.

Nature of Tuberculin Reaction.—According to Pirquet[15] the tuberculin reaction is due to the fact that the tuberculin be-

comes digested by specific antibodies at the place of application. These bodies have been formed by the organism because of a preceding infection by tuberculosis, and they are present in all the fluids and all tissues of the body. The test is, therefore, an allergic reaction, that is, it shows a change in the condition of tissues or, in other words, the organism which reacts to local application of tuberculin by formation of a papule possesses a hypersusceptibility toward toxins and metabolic products of tubercle bacilli which was acquired by a preceding tuberculous infection.

Wolff-Eisner's[16] idea of the reaction is that the lysins of the body of a tuberculous individual produce special bodies by destruction of tubercle bacilli.

Moro[17] thinks that the tuberculin reaction is a specific nervous allergia which is manifested by a local angioneurotic inflammation.

Technic.—Tuberculin tests are divided into qualitative and quantitative. The simplest of the qualitative tests is the von Pirquet test.

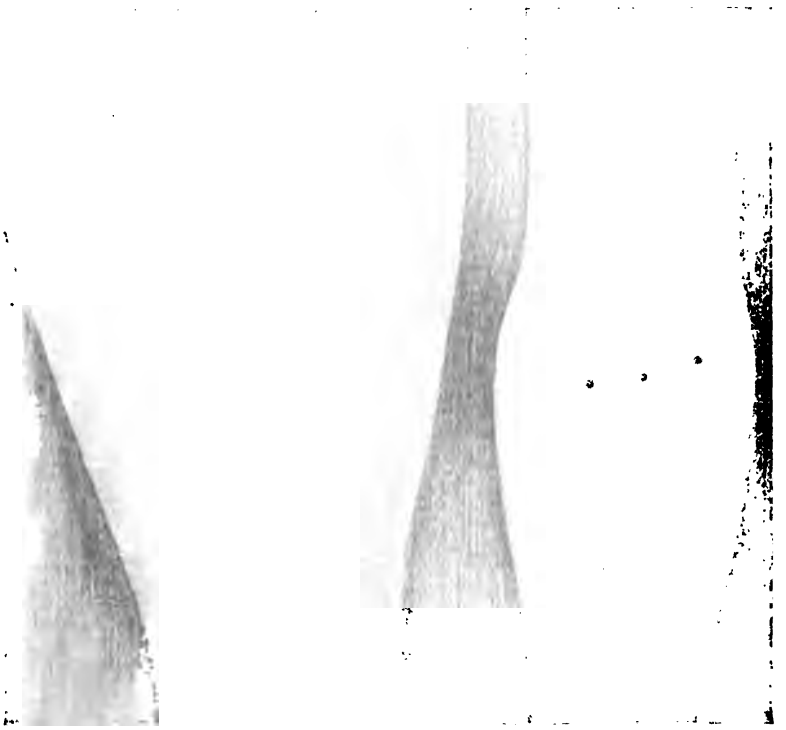
The skin is cleansed with alcohol or ether and 2 drops of tuberculin applied about 5 cm. apart. With a suitable instrument, preferably a platinum-pointed borer, a superficial abrasion is made in the skin between the two drops, and then a similar abrasion is made through each drop of tuberculin. Two drops of tuberculin are used to judge the uniformity of the technic, the abrasion without tuberculin as control.

No dressing of any character is required.

The tests are inspected at the end of twenty-four hours and the points where tuberculin was applied carefully compared with the control abrasion and, where possible, again at the end of forty-eight hours; when only one inspection is possible, forty-eight hours is preferable.

Reaction.—The reaction is positive when a papule forms which is visible and palpable for several days. The control shows the so-called traumatic reaction, which consists of a swelling with rose-colored areola, which shows after several hours a scab with red margins.

PLATE 3



A *B*

A, Quantitative intradermal tuberculin reaction. Reading from above down: 1, Control; 2, 1/20000 mg.; 3, 1/2000 mg.; 4, 1/200 mg.; 5, 1/20 mg. Salt solution is used for the control and old tuberculin for the tests.

B, Test on forearm: Von Pirquet cutaneous tuberculin test (positive reaction, showing two positive reactions and control in center following the application of full-strength old tuberculin). Test on arm: Mantoux intradermal tuberculin reaction following the intradermal injection of 1/2000 mg. of old tuberculin.

The reactions are usually designated as follows:

1. Negative reaction; no appreciable difference between the tuberculin areas and control.

2. Slight reaction; definite, but slight redness with some infiltration.

3. + reaction; wider area of redness, with a definitely raised center.

4. ++ reaction; wider areas of redness, with more marked infiltration than +.

5. +++ reaction; unusual redness and wide area of infiltration including all cases which go on to vesiculation.

Types of Reaction.—1. The *usual* or *typical* tuberculin reaction begins to appear in from four to six hours, reaches its maximum in from twenty-four to forty-eight hours, and then rapidly fades, although the infiltration may persist for several days.

2. The *premature* reaction is characterized by a rapid course and slight intensity. It begins in from four to six hours, reaches its maximum speedily, sometimes after only ten hours, and disappears rapidly, not later than on the second day. This type is supposed to occur in patients with manifest tuberculosis who are not doing well.

3. The *persistent* reaction begins like the others, but reaches its maximum slowly and gradually, usually at the end of the second day, and in some cases still later, the maximum persisting unchanged for a week, and often for two or three weeks.

4. The *late* reaction makes its appearance after an incubation period of over twenty-four hours, and develops and recedes slowly. The third and fourth of these types are supposed to occur in patients with inactive lesions.

5. The *cachectic* reaction is characterized by infiltration with little or no redness. It can be better appreciated by touch than sight. This type, as the name indicates, is common in late stages of tuberculosis.

6. The *scrofulous* reaction: One or more papules are present and they are surrounded by a painful area of redness often 5–10 cm. in diameter. This type of reaction is seen in children suffer-

ing from exudative diathesis and is seldom seen in adults (Combe, *loc. cit.*).

In a proper study of the reaction the record should show the diameter of the lesion, the intensity of the redness, the amount of infiltration, the size of the central papule, and in older children the amount of pain.

Modifications.—Numerous modifications of the original von Pirquet test have been proposed. In general, these modifications may be arranged into two groups: 1. Those in which the technic is modified in order to make the reaction more reliable and the results more uniform. 2. Those in which the technic has been modified in order to make the diagnosis more specific as far as the activity of the disease is concerned, or in respect to the specific bacillus (human or bovine) causing the disease.

Aside from intracutaneous and subcutaneous tuberculin tests, which will be discussed later, the majority of the modifications of the first group comprise minor changes in the technic. One modification, however, that of Lautier, makes a fundamental change in the test in not scarifying the skin at all and applying 1 per cent. solution of old tuberculin on a pledget of cotton, directly to the skin. Lyman,[18] however, who has studied this reaction and compared it with that of von Pirquet, comes to the conclusion that it is very doubtful whether the Lautier test has any value at all.

Quantitative Tests.—Attempts have been made to perform quantitative cutaneous tuberculin tests in order to be able to judge as to the severity of the disease, whether active or in latent stage, but the results have shown that all these tests have little if any practical value. Ellermann, Erlandsen, and Peterson[19] [20] have brought the technic of these tests to their highest perfection. They have standardized their technic by using tuberculin of definite dilution and by measuring the extent of skin scarification. After the papules appear, they measure them very carefully and, taking an average from these figures, they calculate the degree of the sensitiveness of the individual. With all these refinements of technic one of their conclusions as to the value of these tests is that "there are so many individual variations in each group

(clinically non-tuberculous group, clinically tuberculosis suspected group and definite tuberculosis group), that one cannot diagnose tuberculous disease from the tuberculin titer alone. However, in conjunction with the general clinical symptoms it is a valuable indication. Hamman and Wollman[21] regard it as possessing very little if any practical value, since "exact mathematical calculations are applied to factors of indeterminable variation," and because "the cutaneous test is a relatively rough one and utterly unsuited for quantitative tuberculin tests. Intracutaneous tests alone should be employed in determining the degree of hypersensitiveness."

Differential Tests.—Differential cutaneous tests have been made for the purpose of differentiating between tuberculosis caused by Bacillus tuberculosis hominis and Bacillus tuberculosis bovis. Detre's[22] differential cutaneous reaction consists of performing the von Pirquet test by the simultaneous application, in series, of human old tuberculin and of human and bovine bouillon filtrates. Measuring the resulting reaction in millimeters, he believes himself able to draw reliable conclusions as to whether the patient has been infected with the bacillus of the human or bovine type, and as to whether the disease at the time of the test is active or latent. Several other observers (von Pirquet,[23] Schütz and Vidéky,[24] Hamman and Wollman, *loc. cit.*) report that this method is of no value and is not reliable and not practical.

Cuttaneo[25] reviews the discussions as to the identity of human and bovine tuberculosis and gives his own results in a series of 45 cases of tuberculosis in children treated with both human and bovine strains of tubercle bacilli. He found that some cases of bone, bowel, and gland tuberculosis reacted much more frequently and readily to bovine tuberculin, while, on the contrary, a larger percentage of pulmonary cases reacted to the human form.

H. Nothmann[26] vaccinated a number of children with human and bovine tuberculin. He wished to see whether it could be ascertained in this way which is the infecting organism; 207 children from one to sixteen years of age were tested. From these

56, or 27 per cent., did not react to either. In 145 the test was positive, and in 133, or 91.7 per cent., of these it was positive to both tuberculins; in 2, or 1.4 per cent., to bovine alone, in 9, or 6.2 per cent., to human alone. Nothmann thinks that this method is of no value in determining the variety of the infecting organism. He thinks that only one fact can be gleaned from these observations, that the majority of tuberculous patients react both to human and bovine bodies, and that the homologous group is stronger than the specific group. Therefore, no matter what the variety of infection, a double reaction occurs.

Several other observers report that this method is of no use and is not reliable. This has also been our experience in a large series of cases in which the test was performed simultaneously with human and bovine tuberculins. In most instances both were either negative or positive, and in the latter the reaction was of equal intensity in most cases.

Moro's tuberculin test, in which tuberculin is incorporated in an ointment and the latter then applied with friction to the unbroken skin, has been proposed as a modification of the original Pirquet test, but this test possesses no advantages over the Pirquet test.

Intracutaneous Tuberculin Test.—Although Mendel first suggested intracutaneous use of tuberculin, it is to Mantoux[27] that we are indebted for its practical application. He employed 1 : 10,000 dilution of old tuberculin, and injected $\frac{1}{10}$ c.c. of this solution, thereby administering 0.005 mg.

Hamman and Wollman have modified his technic to the extent of using increasing dosage of tuberculin, making four simultaneous injections of increasing strength. They describe the technic as follows:

"We make four simultaneous injections. The first consists of $\frac{1}{10}$ c.c. of pure salt solution as control; the second of $\frac{1}{10}$ c.c. of 1 : 1,000,000 dilution of old tuberculin, equals 0.00005 mg.; the third of $\frac{1}{10}$ c.c. of a 1 : 100,000 dilution of old tuberculin, equals 0.0005 mg.; the fourth, of $\frac{1}{10}$ c.c. of a 1 : 10,000 dilution of old tuberculin, equals 0.005 mg. If none of the areas react, we may perform a second test upon the opposite arm, injecting $\frac{1}{10}$ c.c.

of 1 : 1000 dilution of old tuberculin, equals 0.05 mg., and $\frac{1}{10}$ c.c. of 1 : 100 dilution of old tuberculin, equals 0.5 mg. In this way a more accurate estimate of the degree of hypersensitiveness is obtained than from a single injection."

In our own work we have used $\frac{1}{10}$ mil. of the third dilution, thereby administering $\frac{1}{10}$ mg. of tuberculin as a ward routine, frequently making use of the serial dilutions in studies where it was thought that information as to the degree of hypersensitiveness would be of value. But we have been unable to draw any definite conclusions as to the prognostic value of this latter method.

In performing intracutaneous tuberculin tests the skin is put on the stretch and the needle introduced very superficially, almost parallel to the surface, so that its point remains in the epidermis. Then inject $\frac{1}{10}$ mil. of the solution, which will form a small vesicle in the skin if the injection was properly made.

When the reaction is positive, an infiltration of white or pink color appears in several hours. It increases during the first twenty-four hours, attaining its maximum on the second day. The nature of the infiltration at that time is of rose or pink color, occasionally pale, edematous. Exceptionally in its center several purpuric points may be seen. Around the entire region of infiltration a halo of rosy erythema develops. Occasionally an intermediary zone separates the central nodule from the peripheral halo.

The place of infiltration is rarely smaller than 1 cm., frequently larger than 2 cm.

The reaction begins to retrogress the second or third day. The peripheral halo disappears first. The central nodule takes on a violet tinge, later brownish, and is being gradually absorbed.

Atypical reactions are extremely rare, and they are observed chiefly in cachectic individuals. They are usually slow in their appearance, appearing on the second day and attaining their maximum on the third day. They must be differentiated from pseudoreactions, which are only the result of the injury done to the skin during the test.

As a possible source of error in performing this test it has been pointed out that certain diseases may possess an extreme sensi-

tiveness to tuberculin. Mantoux found, however, that the individuals who did not react to an injection of $\frac{1}{100}$, did not give intradermal positive reactions even when the dose was fifty times as much.

The intracutaneous test is more sensitive than the cutaneous test of von Pirquet. In our experiments, whenever the cutaneous test was positive the intradermal test was also positive in all cases, and, besides that, the intradermal reaction was positive in many cases where the cutaneous reaction was negative. But not even by this more delicate test is it possible to differentiate between infection with human type and that with bovine type of Bacillus tuberculosis.

There are four advantages of the intradermal test over the cutaneous test of von Pirquet:

1. More exact dosage.
2. Earlier reaction.
3. More distinct reaction.
4. More reliable, because of the certainty of absorption.

Subcutaneous Test.—Hamburger depot reaction or subcutaneous tuberculin test has also been recommended for the diagnosis of tuberculosis. It appears, when positive, in ten to twenty-four hours as swelling of subcutaneous tissue in the place of injection, the swelling being 20 to 70 mm. in diameter, and is often but not constantly associated with reddening of the overlying epidermis. Often when no reddening is present and the reaction in general is mild, it may better be palpated than seen. In case of uncertainty it is advisable to palpate at the same place on the opposite side.

In order of their sensitiveness the various cutaneous tuberculin tests may be arranged as follows:

1. Intracutaneous test.
2. Subcutaneous local test.
3. Cutaneous test.
4. Percutaneous test.

This relation is definite, but not absolutely constant.

Histopathology.—The structure of the papule which occurs

in positive cutaneous tuberculin test points to its origin through a histologic reaction of a specific kind. Bandelier and Kreibich,[28] Daels,[29] and La Page,[30] who have made microscopic examinations of the papule, found changes identical with the specific structure of tubercular tissue or of tubercle itself.

Specificity.—Much discussion and a large amount of clinical, postmortem, laboratory, and experimental studies have been done on the question of specificity of the cutaneous tuberculin tests. There are two questions which must be considered and definitely answered before deciding the question of the specificity of the cutaneous tuberculin tests:

1. Does the tuberculin papule occur in tuberculous individuals only? Or a modification of this question: Does the tuberculin papule ever occur in a non-tuberculous individual?

2. Does the tuberculin papule occur in all tuberculous individuals? Or a modification of this question: Is the tuberculin papule ever absent in a tuberculous individual?

In answering these questions it is to be kept in mind that the cutaneous tuberculin test is a practical test, and that, therefore, it is sufficient to prove its practical specificity, to prove its specificity in practical terms, or in other words, to prove that it is specific under the usual conditions of its technic and its interpretation. This relieves us of the duty of proving that the production of tuberculin papule is absolutely specific, that is, that there is no other substance with which we can artificially produce a tuberculin papule; but even this absolute specificity seems to be highly probable if we apply as criterion histologic structure of the papule. Thus, it is not necessary to discuss either the report of Entz,[31] who found that the formation of papules identical (macroscopically) with those seen after tuberculin tests may be produced by other toxins (diphtheria, typhus, paratyphus, pyocyaneus) in about the same percentage of cases, or conclusions of Tezner,[32] who states that the Pirquet reaction is not absolutely specific, but that it is a sign of a somewhat more general allergia, most probably an increased reactive ability against proteins of all bacteria with which the organism is infected at the time at which the reaction is performed, but that from a clinical point of

view, however, the Pirquet reaction remains specific not for the toxin, but for the infected.

Kasahara[33] has made histologic examinations of the papules produced by vaccinating with tuberculin, diphtheria toxin, and atoxyl. Macroscopically, these skin reactions are very similar, but histologically Kasahara found decided differences. The papule resulting from the tuberculin test showed giant cells and infiltration of lymphocytes around the blood-vessels. The giant cells were due to irritation by the tuberculin. The diphtheria toxin papules showed decided changes in the vessel walls. There was thickening of the intima, dilatation and engorgement of the vessels, and a fibrinous inflammation of the corium. The atoxyl papule showed a somewhat marked lymphatic infiltration into the corium. Kasahara thinks that this histologic study is proof that the tuberculin reaction is a specific one.

In discussing the specificity of the cutaneous tuberculin test three things must be kept in mind constantly: 1. What is a tuberculin papule? 2. Who is considered as a tuberculous individual? 3. Conditions of the skin necessary for the production of any reaction.

A tuberculin papule is a papule occurring after cutaneous administration of tuberculin and having histologic structure of a tubercle. For practical purposes its macroscopic characteristic, as previously described, and the fact that the place where control scarification was made shows no papule, are usually sufficient to regard a papule as a tuberculin papule.

As tuberculous individuals are to be regarded not only those that show at present clinical evidence of tuberculous disease, but also those clinically healthy individuals, who have either a latent or a healed tuberculous focus, having been at some time infected with Bacillus tuberculosis. Clinical findings of tuberculosis are sufficient in many cases to regard an individual as tuberculous; absence of clinical findings, however, is not sufficient to exclude the diagnosis of tuberculosis. The best criterion for deciding this question is an autopsy, but in this also it is the positive result that is of absolute value, the negative results having a relative value only. Ghon,[34] in his description of 747 autopsies in children,

found 184 cases of tuberculosis, and in 95 per cent. of the latter cases was able to demonstrate the primary lesion in the tissues of the lungs. He believes that the cutaneous reaction is specific for tuberculosis and that without the positive tuberculin reaction he might easily have discontinued his search for the primary lesion in several autopsies because of his failure to find it upon superficial anatomic examination. However, in all of his cases except 2 he was able to demonstrate tuberculosis, and in these latter 2 cases in which the reaction was positive, but in which he was not able to demonstrate a tuberculous lesion, he is inclined to believe that this was due to his inability to find them and not to an absence of tuberculous infection. Et Shang,[35] in autopsies on 210 subjects, found tuberculosis in 94 per cent. of all cases, and 61 per cent. of these presented no symptoms of tuberculosis during life.

The following table shows the relation between the positive cutaneous tuberculin test and the result of autopsies in these cases.

Observer.	Number of positive reactions.	Tuberculous lesions found at autopsy in—	Percentage of positive cutaneous reactions confirmed by autopsies.
Ganghofner[36]	15	14	93
Müller[37]	22	22	100
Ruck[38]	240	229	95
Total	277	265	Average.. 96

Thus in 96 per cent. of these cases the cutaneous test was absolutely confirmed at autopsy; the remaining 4 per cent. may probably be charged to the inability of finding tuberculous lesions, although they were present.

Pirquet[39] had one case which gave a positive reaction, and in this child no tuberculosis was found at autopsy, but signs of exudative diathesis (Escherich's lymphatismus). Pirquet explains it by saying that there is a very close relationship between lymphatism and tuberculosis and that lymphatism is probably a latent tuberculosis.

We have studied a series of 15 children suffering with exuda-

tive diathesis in whom only 6 reacted to the cutaneous test, which leads us to believe that children, at least in greater part, who are non-tuberculous do not react even though they are suffering with exudative diathesis. In the 6 cases who did react, it was very intensive, the large infiltrated area existing for a much longer time than that of the ordinary reaction. This was especially true in cases suffering from involvement of the mucous membranes and those with phlyctenular keratitis and with marked glandular involvement, which were undoubted cases of tuberculosis. It is our belief that the cutaneous reaction is, therefore, of considerable value in distinguishing the simple cases of exudative diathesis from cases of exudative diathesis with secondary tuberculous infection.

Next, the question is to be discussed whether tuberculin papule occurs in all individuals diagnosed as tuberculous on the basis of either autopsy or clinical findings, other than cutaneous test.

The cutaneous test is not positive in all tuberculous individuals. It may be negative in a number of conditions associated with tuberculosis and in some uncomplicated cases of tuberculosis, especially when the disease is severe.

The conditions associated with tuberculosis in which cutaneous tuberculin reaction may be negative, and often is negative, but usually temporarily only, are:

1. Acute infectious disease, especially exanthematous fevers: Measles (always absent), scarlatina (absent in exanthematous stage), typhus abdominalis, erysipelas. Sensitiveness is markedly diminished or may be absent in pneumonia, diphtheria, and acute articular rheumatism.

2. During pregnancy the positive results of the cutaneous reaction diminish by 50 per cent., and the decrease becomes especially marked after the sixth month.

3. After the introduction of larger doses of tuberculin, as is done for therapeutic purposes. The susceptibility, however, returns afterward.

4. Cachexia from any cause by producing loss of general reactivity of the skin.

5. The following forms of tuberculous disease: Miliary, meningitis, peritonitis, advanced tuberculosis. Some cases of healed and encapsulated, inactive tuberculous foci. Very low reactive capacity of the skin.

In our own experience in making the cutaneous tuberculin test on 630 children we had 15 negative reactions when the clinical diagnosis of tuberculosis was readily made by means other than cutaneous tuberculin test. They were as follows:

Tubercular meningitis, 10.
Marked pleurisy, 2.
Advanced pulmonary tuberculosis, 2.
Severe tuberculosis of hip-joint, 1.

In the cases in which cutaneous tuberculin reaction may be negative even in the presence of tuberculosis we have had the following results:

	Positive.	Slight.	Negative.
Pulmonary tuberculosis	5	2	2
Tubercular meningitis	2	0	10
Tubercular peritonitis	1	4	0
Miliary tuberculosis	2	0	0
Tubercular pleurisy	2	0	2
Tuberculous joint disease	2	0	1

If, therefore, after exclusion of the above enumerated conditions, which may readily be diagnosed by usual clinical methods, we find cutaneous tuberculin reaction positive, we may make a diagnosis of tuberculous infection, which is certain for all practical purposes at least.

Blümel[15] comes to the following conclusions in regard to the specificity of the cutaneous tuberculin reaction: "The cutaneous tuberculin reaction is specific, its presence indicating that the individual is tuberculous, although the disease may be in its healed stage. The specificity of the reaction is proved also by autopsies in many cases. The local changes at the place of inoculation, that is, the papule, corresponds in its minute structure to the structure of a tubercle. By histologic examination it is found that regular tubercle develops made up of epithelioid and giant cells, as well as of the cells of Langhans' type. These structures are not formed by the action of tuberculin *per se*, since

tuberculin is primarily non-toxic, but only in individuals who have been infected previously by tuberculosis the reaction appears."

Meaning of Positive Reaction.—Positive Pirquet test gives indication of present or previous tuberculous infection, and not necessarily of active tuberculous disease.

The quality of the reaction is also of little importance for diagnosis of the intensity of the process, although intensive reaction with the first test means that recently something has occurred; the process may, however, be progressive or retrogressive and of diagnostic value only when clinical findings are considered; however, it may be stated that the younger the patient, the more the likelihood of an active process.

The time of appearance of the reaction is of importance for the diagnosis. Weak positive reactions occur as follows:

1. In an organism once infected, but not now at the height of the infection.
2. May occur in active pulmonary lesions, especially in adults.
3. Miliary tuberculosis and meningitis late in diseases.
4. During or following acute infectious diseases.
5. Previous treatment with tuberculin with overpowering doses.

In children up to two years of age, in whom inactive foci of tuberculosis are extremely rare, the positive Pirquet reaction usually means:

1. Active tuberculosis.
2. It is very often the first sign of tuberculosis at a time when clinical diagnosis of tuberculosis is not possible by any other method.

Meaning of Negative Reaction.—Negative reaction to Pirquet cutaneous tuberculin test, especially if made twice, occurs only in individuals entirely free from tuberculosis, and in definite exceptions, as stated previously.

Diagnostic Value.—The chief value of the von Pirquet reaction lies in its importance for the diagnosis of tuberculosis in infants and young children. Positive reaction is of considerable value in diagnosis during the first year of life, of less during the

second year, of little in childhood, and none in the adult life. On the other hand, a negative reaction excluded, with definite exceptions, the presence of tuberculous lesion. There are, however, certain limitations in the interpretation of the test which are worthy of mentioning. The cutaneous test is not a reliable diagnosticum in itself; it must rather be regarded as a help in clinical examination and observation. These latter ones must always give the answer to the question: Is the present case one that needs treatment or not? The cutaneous tuberculin test cannot, therefore, be used to determine whether a surgical disease of bone or joint is of tuberculous origin or not. It is a mistake to attribute to tuberculosis anomalous auscultatory findings in apices of the lungs because the Pirquet test was positive. Topical diagnosis is not possible by the cutaneous test except possibly in children up to two years of age, in whom inactive foci of tuberculosis are extremely rare. At that age the test is valuable for diagnosis of tuberculosis of lymphatic glands. It is also very good for differential diagnosis between tuberculosis and marasmus, anemia, bronchitis, glandular swellings, cutaneous and bone affections, as well as in beginning meningitis in children up to two years of age.

Scrofulosis gives positive cutaneous reaction without exception. This shows the presence of tuberculous infection, which is usually benign, being manifested by lesions in glands and bones, and only exceptionally leading to pulmonary or miliary tuberculosis.

Exudative diathesis and *lymphatismus* which otherwise can be separated, but with great difficulty, from scrofulosis, can easily be differentiated by Pirquet test. Scrofulosis is today designated as tuberculosis of the lymphatic child, and it can be assumed that the symbiosis of tuberculosis with lymphatism makes the course of tuberculosis milder (Blümel, *loc. cit.*).

Phlyctenulæ give positive cutaneous reaction in over 70 per cent. of cases. In cases diagnosed as phlyctenular keratitis that did not react to the Pirquet test, exudative diathesis has often been determined either from the history or by clinical examination, so that in these tuberculosis-free cases the exudative diathesis has been looked upon as a factor in etiology of eye findings.

The authors question the diagnosis of phlyctenular keratitis in non-tubercular individuals.

Orthotic albuminuria gives very frequently a positive cutaneous reaction, so that one is inclined to bring this disease into connection with tuberculosis, and to regard the orthotic albuminuria as an early symptom of tuberculosis (Blümel, *loc. cit.*).

Pirquet reaction is of no value in choosing wet-nurses (Paten[40]).

Prognosis.—As in diagnosis, the test ought to be only supplementary for prognosis, which is to be made primarily on clinical findings. The Pirquet reaction, no matter how intensive, does not give any indication for prognosis except in infancy, where the prognosis is unfavorable. The negative outcome of reaction in a case of manifest tuberculosis is an unfavorable sign for prognosis. This is true in many cases, but not in all. Cohn[41] found that out of 18 children infected with tuberculosis in the first year of life, 16 died, and in 2 cases only generalized tuberculosis did not occur during the time of observation extending over one year and six months.

Positive test means: 1. In infants, developing tuberculosis and a grave prognosis. 2. In older children, beginning with the second year of life and in adults, it indicates presence of a tuberculous focus in the body, or it is a sign that the individual has been sensitized by tubercle bacilli at some time previous to the test.

Negative intradermal test does not exclude tuberculosis. In the first place, the infection may be recent and the individual may not have had time to produce sufficient antibodies to cause reaction. Where this is suspected, the test should be repeated every month for at least three months. Again, it may be negative because of absence of sufficient antibodies necessary to a positive reaction, either due to overwhelming infection or to some other causes, as have been previously enumerated.

It is interesting to study the frequency of the positive von Pirquet tuberculin reaction in different ages. While the percentages given by different authors vary, all agree that the percentage of positive tests steadily increases during infancy and childhood, to reach a very high figure during the adult life. In the very old

the frequency of the positive results becomes again less than during the adult life.

Paten (*loc. cit.*) performed the Pirquet test on 53 children in ages from one to fourteen days and four infants in the third and fourth week. The result was that not a single child showed even a trace of reaction. All the mothers of these infants except 2 primiparæ showed a positive reaction which, however, in most of the cases was very slight.

On the other hand, Moro[42] states that young infants would not react to the Pirquet test even if they had tuberculosis. The reason for this is probably the fact that the cells of the skin at this time are not yet sufficiently able to form antibodies.

Very few cases of positive cutaneous tuberculin reaction have been reported in children below three months of age.

Müller[43] performed the cutaneous tuberculin test on 160 children up to the age of three months, and found that 13 of them reacted positively, that is, 8 per cent.

A number of other observers could never find positive cutaneous reaction in infants under three months of age—*e. g.*, Sperk (159 cases), Faludi (195 newborn), von Pirquet, Ganghofner (10 cases). L. Cohn (*loc. cit.*) states that below the third month the reaction is always negative.

In a series of 630 children up to fifteen years of age we have obtained positive reaction in 55 cases, and slightly positive reactions in 27 cases. There were 50 cases under three months of age, and of these we have obtained one positive and one slightly positive reaction.

Von Pirquet performed the cutaneous tuberculin test on 988 children and obtained the following percentage of positive reactions:

Age.	Per cent.
0 to 3 months	0
3 to 6 months	5
6 to 12 months	16
1 to 2 years	24
2 to 4 years	37
4 to 6 years	53
6 to 10 years	57
10 to 14 years	68
Over 14 years	90

In our 630 cases in Michael Reese Hospital in whom the cutaneous tuberculin reaction was made, we obtained the following percentages of positive reactions:

Age.	Per cent.
0 to 3 months	2
3 to 6 months	5
6 to 12 months	4
1 to 2 years	8
2 to 3 years	2
3 to 4 years	8
4 to 6 years	15
6 to 10 years	17
10 to 15 years	10

Even if we include among the positive cases our slightly positive cases, then the results in percentage, although getting nearer to the von Pirquet figures, yet remain, on the whole, considerably below those given by von Pirquet, and we get the following table:

Age.	Per cent.
0 to 3 months	3
3 to 6 months	7
6 to 12 months	9
1 to 2 years	11
2 to 3 years	28
3 to 4 years	16
4 to 6 years	19
6 to 10 years	22
10 to 15 years	22

While many constitutional reactions and focal changes have been reported following the subcutaneous injections, we have never seen any serious results following the cutaneous use of tuberculin where even the simplest rules of cleanliness have been followed. We have seen only one case of systemic involvement which, we believe, could be traced to the intracutaneous use of tuberculin for diagnostic purposes. Thus we may say that the Pirquet test, especially in comparison with other tuberculin tests, is devoid of any danger.

SUMMARY

1. Tuberculin skin reaction is specific in its nature.

2. Except in the presence of certain well-defined pathologic conditions the tuberculin reactions are always positive in the

presence of tuberculous infection. In the absence of such exceptions a negative reaction, with proper technic, is of great value in differential diagnosis.

3. Tuberculin reactions are of great value in diagnosis in infancy and young children.

4. The intracutaneous tuberculin test is the most delicate and most reliable tuberculin test, the von Pirquet cutaneous test ranks next.

5. The tuberculin reactions should be considered in the light of adjuncts to careful clinical examination and observation, and not as definite means of diagnosis or establishing a prognosis.

6. They are also of great importance in the study of the etiology and prophylaxis of tuberculosis.

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CLINIC OF DR. FRANK WRIGHT

MICHAEL REESE HOSPITAL

NEPHRITIS

Determination of the Treatment of Each Case from the Findings.

THE two patients about to be shown today give little difficulty in making a diagnosis of their disease—nephritis. They are presented because careful consideration of many of the findings is of distinct help in the treatment of people with diseased kidneys and has a decided bearing upon the prognosis in these cases.

If, at the outset, we take careful note of the fact that in all cases of nephritis there is diminished or delayed excretion of one or all of the urinary constituents, and that the close study of the rate at which these bodies are excreted, or the findings of a disturbance in the quantitative relation of these same bodies in the blood, rather than the determination of the amount of albumin or the number of casts, gives us the best information regarding the severity of the nephritis.

The manner in which urine is secreted under normal conditions has been the subject of discussion by physiologists for over seventy years; it is, then, not to be wondered at that the altered secretion in the various types of nephritis has been a puzzle that is of slow solution, and is as yet far from being satisfactorily explained. However, certain clinical facts recently brought to light do seem of distinct assistance in summing up the clinical picture, and these are the points I wish to emphasize today.

How the normal kidney is able to form from the blood-plasma a fluid of greater concentration and higher osmotic pressure than that of the blood has been a stumbling-block. The theory of "vital secretion" of Heidenhein fails to explain satisfactorily; the kidney does not "secrete" urine in the way that the pancreas secretes its juice or the submaxillary gland its saliva. Nor is

the kidney endowed with the power of picking out substances from the blood with uncanny accuracy, especially when these substances embody such a great variety as urea, alkaloids, dye stuffs, and salts.

The so-called "modern theory," well presented by A. R. Cushny in his monograph on the Secretion of the Urine, offers an accurate survey of the present knowledge of the subject. Quoting in part:

"The secretion of urine consists of two distinct processes, differing not only in site but also in nature. The first of these, the filtration, occurs in the glomerulus, and is purely physical; the second, reabsorption, occurs in the tubules and depends on the vital activity of the epithelium."

The energy supplied by the blood-pressure is not sufficient to perform the whole work of secretion, and the kidney itself furnishes the greater proportion of the energy required. The pressure in the glomerular capillaries suffices for filtration, and the capsule filters off the colloid substances of the blood, principally the protein, while allowing the rest of the constituents to pass through without alteration in their relative concentration; the glomerular filtrate is then practically deproteinized plasma. In its passage through the tubules this fluid is altered by the absorption of certain of its constituents by the epithelium; the passage of the absorbed water and solids of the glomerular filtrate is an active absorption.

Filtration, then, through the renal capsule is quite like that through any filtering medium dependent upon several factors: (1) the pressure on the proximal side of filter—if the capillary pressure be high more fluid is passed through—this has decided clinical evidence to support it; (2) the character of the membrane —the renal capsule shows variability in different individuals and in the same individual at various times. This is especially true in pathologic conditions; for example, when the oxygen supply is insufficient in cardiac decompensation, the resistance to permeation rises rapidly; (3) the nature of the fluid subjected to the process, the filtrand; because of the fact that the large molecules of the colloids (*e. g.*, the proteins) do not pass, an increase in the

quantities may lessen the rapidity of filtration by holding the water on the proximal side—conversely, a diminution in the amount of colloid following dilution by ingested fluid increases the amount of filtrate from the capsule.

Absorption, taking place in the tubules, is the means by which the glomerulus filtrate is changed in composition and concentration to the urine which passes out of the ureter. A great portion of the water is absorbed, as are the chlorids and practically all the dextrose. Sodium is absorbed readily, potassium with difficulty, which explains why potassium salts are useful as diuretics. The constituents of the plasma, called "threshold bodies," are taken up by the tubules in definite proportions, dependent upon their values in the blood; "no-threshold bodies," like urea, are not absorbed, but escape through the ureter. The cells lining the tubules absorb from the glomerular filtrate, then, a slightly alkaline fluid containing sugar, amino-acids, and similar food substances, chlorid, sodium and potassium, in about the same proportion in which they are present in normal plasma.

The function of the kidney may then be defined as the filtration of the non-colloid constituents of the plasma through the capsule, and the absorption of what is practically Locke's fluid through the tubules. The capsule provides the tubules with the fluid as it exists in the circulation, the tubules return to the blood the fluid best needed for the tissues, the rest escaping in the urine. If the plasma be too rich in chlorid or sugar, the filtrate retains the excess above the threshold amount, which is returned by the tubules. If the filtrate be dilute after heavy water ingestion the excess of water is left in the urine after the abstraction of the so-called optimal fluid by the tubules.

Turning now to the first patient we find a woman of twenty-five, a stenographer, first coming under my observation two years ago. Her mother died of pulmonary tuberculosis. At the age of fourteen she had a severe scarlatina, complicated by nephritis. At twenty-two and a half years repeated attacks of tonsillitis resulted in the removal of the tonsils. A few months later I saw her for the first time with a well-marked parenchymatous nephritis with secondary anemia of high grade—without doubt a re-

crudescence of a former nephritis. Rest, diet modification, and Basham's mixture resulted in improvement, and for nearly a year the patient has worked regularly; her urine showing little albumin and few casts.

January 6, 1918, she was seen with a fever of 103.6° F. due to a bronchopneumonia. At this time the urine was of the febrile type, 360 c.c. in twenty-four hours, 1030 gravity, containing much albumin, with many hyaline and granular casts. The recovery from the pneumonia was uneventful, the temperature being normal on the eighth day. The urine, however, became more scarce, and on the fourth day gave evidence of an exacerbation of the nephritic condition. This day 280 c.c. of urine, laden with a large quantity of albumin, blood-cells, granular as well as hyaline casts. Tympanites, pain in the lumbar region, a symptom popularly supposed to accompany a kidney lesion, yet rarely found unless the condition is quite acute, and vomiting followed. Edema began first in the lower part of the face, giving the appearance of a square, heavy set jaw, then pitting of the ankles and feet could be made out, and lastly, edema of the lids. The vomiting continued stubbornly. At this time examination of the blood for its CO_2, combining power, and of the alveolar air gave proof of a moderate acidosis. Administration of sodium bicarbonate promptly alleviated the vomiting, but was followed by very noticeable increase in the edema—the weight increasing 4 pounds the first day and more than 3 the second. On substituting chalk mixture complete cessation of all emesis resulted. Practically all salt was eliminated from the diet, yet the patient's weight increased from 114 to 138 pounds in twelve days. The diet was salt poor and non-nitrogenous, with restricted fluids until the vomiting ceased, when the Karrel plan was followed, with the result that the steadily increasing edema was brought to a standstill, then diminished slowly; the weight at present is 126 pounds.

In the meantime the loss of albumin in the urine has ranged from 4 to 11 grams daily, and the total loss in the fifty days of her illness has been approximately 345 grams. It has been estimated that the total amount of protein in the blood of an average individual is something over 200 grams, so that such a loss,

coupled with a restricted intake, might make a change in the serum protein in this particular individual. Estimation of the total protein, serum albumin, and serum globulin gave the following results:

	Total protein.	Serum albumin.	Serum globulin.	Globulin, per cent.
This patient.....	5.60 gm. per 100 c.c.	2.34	3.26	59
Normal persons.....	7.50 gm. per 100 c.c.	5.03	2.47	33

For comparison I have included the results obtained by analysis of the serum of a normal individual—figures which are quite in accord with those of other investigators, such as Epstein.

Normally in 100 c.c. of serum 6 to 8 grams of protein are found, of which approximately one-third is globulin, the remainder serum albumin. In this case in which the total protein is but 75 per cent. of what is usually found, the reduction of the amount of serum albumin is the striking feature. This is but half of the average quantity. The disproportion between the albumin and globulin is further emphasized by the high percentage of globulin, nearly 60 per cent., in place of the 33 found in the normal individual. The non-protein nitrogen was 36 mg., the urea 28, and uric acid 1.2 mg. per 100 c.c., all within normal limits. Coupled with this diminution of the serum albumin is the fact that the protein in the urine was practically all albumin, no globulin being found.

From these findings one may logically conclude—

(1) That the daily loss of albumin and not globulin in the urine, if continued a sufficient length of time, does influence the total protein content of the blood-plasma, especially the albumin portion of the protein.

(2) That in the management of such a condition steps should be taken to furnish protein to the circulation if satisfactory results are attained.

(3) Lastly, if the diminution of the protein content of the plasma be sufficient, the osmotic pressure may be so reduced that absorption or retention of fluid by the tissues is favored and edema easily results.

As applied to this patient the treatment instituted is first

for the modification of the edema—the use of the Karrel milk diet, using skimmed milk in place of whole, as most nephritics do not tolerate fats well.

Next, the transfusion of blood by the citrate method after the removal of an equal volume of the patient's blood. This has been done to good advantage by other clinicians; the abstracting of a sufficient volume to prevent overloading of the circulation, as well as to remove toxic material and lipoids, the infusion to increase the quantity of protein which we know to be deficient.

Lastly, and most important, the maintenance of a diet which will furnish protein, a moderate amount only of salt, and a quantity of fluid which is not excessive; about 1200 c.c. daily.

As for the foods used, I have found those suggested by Epstein to be of distinct aid. This list includes lean veal, lean ham, whites of eggs, oysters, gelatin, lima beans, lentils, split peas, green peas, mushrooms, rice, oatmeal, bananas, skimmed milk, weak coffee, weak tea, and cocoa. The amount of fat is kept at a minimum, and of carbohydrates about 200 grams, because of the tendency of water retention if too great quantities are ingested.

In the early stages I have also used amino-acids—*e. g.*, protein—a larger part of which is digested to the amino-acid stage.

This second patient is shown because the findings in his blood are so diametrically opposed to those of the first that the great range of symptoms and findings associated with disturbance of kidney function may be emphasized.

The man is a merchant, fifty-four years of age. Without going into detail about his medical history, I can say it was uneventful. He has had no severe illnesses, no venereal diseases. The man worked hard, ate too much and too hurriedly, smoked excessively, and drank moderately. Two years ago he applied for life insurance, was rejected because of abnormally high blood-pressure, after which, as he says, he became sick.

Physical examination at that time showed the findings so frequently noted; the moderate enlargement of the heart to the left, the accentuated second sound in the aortic area, a systolic blood-pressure of 190, diastolic 112. The urine was of low specific gravity, 1012, large in amount—2100 c.c.—gave a faint test for

albumin, and microscopically a few granular and hyaline casts were seen.

The Mosenthal test for kidney function gave evidence of a tardy excretion of fluid and nitrogen and an inability to concentrate, the specific gravities varying but little during the twenty-four hours. The amount passed at night was large. The phenol-sulphonephthalein excretion was low—38 per cent. in two hours.

During the two years that have elapsed the patient has followed directions explicitly and changed his whole mode of living. He works but four hours a day, taking frequent vacations; he does not smoke or drink, and his diet has consisted exclusively of milk, buttermilk, cooked and green vegetables, nuts, cereals, stewed and raw fruits. He has lost 15 pounds, his weight at present being 154. His systolic blood-pressure today is 162, diastolic 104.

The point I wish to emphasize is the clinical findings in the blood:

Milligrams per 100 c.c. of Blood

	Non-protein nitrogen.	Blood urea.	Uric acid.
Today	44	39	3.3
22 months ago	62	48	Not estimated.

For comparison I add the findings in the blood of the first patient.

Milligrams per 100 c.c. of Blood

Non-protein nitrogen.	Blood urea.	Uric acid.
36	28	1.2

The estimation of the serum proteins was made in this case also. For contrast I will append the findings of the first patient and then of the average:

Grams per 100 c.c. of Serum

	Total protein.	Serum albumin.	Serum globulin.	Globulin, per cent.
Second patient.				
Chronic interstitial nephritis and hypertension	8.2	5.7	2.5	30
First patient.				
Chronic parenchymatous nephritis	5.6	2.3	3.2	59
Average normal individual	7.50	5.03	2.47	33

To sum up the findings in the two cases:

Both show a disturbance of excretion by the kidney and a changed relation of the constituents of the blood.

The first case, that of chronic parenchymatous nephritis, attracted attention by the diminished excretion of water and large quantities of albumin in the urine, while from the standpoint of the blood a poverty of serum albumin with resulting edema. There is no retention of non-protein nitrogenous constituents.

The second case shows a large excretion of fluid by the kidney, very little albumin, a lagging as to rate of excretion, too large a portion being left for excretion at night, and a fixation of specific gravity at a low figure.

In contrast to the first patient the disturbance in the blood relationship is evidenced by a retention of the non-protein nitrogenous bodies, while the protein content is undisturbed.

The bearing of these facts as to management is quite clear. The patient with parenchymatous nephritis requires, first, active steps to combat the edema; second, to replenish the lost albumin. This means the feeding of protein containing foods which are readily assimilated—at the same time restricting the quantities of fluid, fat, salt, and, to a less extent, carbohydrate. To bridge over the stage following the diminution of the edema transfusion of blood and the feeding of protein disintegrated to the amino-acid stage is to be recommended.

The patient with interstitial nephritis and hypertension is the one requiring careful and constant supervision and restriction as to diet. This particular individual even with care extending over a period of two years still has abundant evidence of the retention in his blood, and while the kidney may excrete enough for his immediate needs, he can ill afford to burden his excretory organs with even a slight excess of protein.

The fact that the human body often does better with a few smaller amounts of protein than is usually eaten will be brought home to many of us through the food restriction imposed by the great war—and undoubtedly to our benefit.

CLINIC OF DR. ARTHUR F. BYFIELD,

COOK COUNTY HOSPITAL

SPLENOMEGALY AND CIRRHOSIS OF THE LIVER

January, 1918.

LAST month there came to my service almost simultaneously two young men who passed through the receiving ward with the same diagnosis, namely, Banti's disease. The study of these two cases, which has just been completed, furnishes data which emphasize, in an especially illuminating way, it seems to me, the very close relationship of the Banti picture to the Laennec type of cirrhosis of the liver.

If our time permits, I plan to carry you beyond the consideration merely of this relationship and to take up briefly the problem of the cirrhoses as a whole, from the point of view of the splenic and hepatic changes in the same. Your texts concern themselves chiefly with more or less pure types of Banti's disease, Laennec's cirrhosis, Hanot's cirrhosis, etc., and pay too little attention to the not infrequently encountered mixed or transitional forms. It is these mixed forms, which one finds difficulty in classifying clinically and often anatomically, that are most instructive, and which, in my opinion, indicate that the Banti complex and the different cirrhoses are properly to be regarded not as entities, but as parts of one large process modified in the individual case by the nature, action, and localization of the responsible toxin.

As both of the patients have left my service I shall make use of the hospital records to give you the necessary data.

CASE I.—(F. P., Patient No. 652,544, Ward 63).

The first patient is an Italian, twenty-four years old, who has been in America for seven years and has lately been employed in the steel mills.

His present complaints are practically all of seven months' duration. They are: 1. Dull pain, or a feeling of weight, in the upper left abdomen, first noticed when he stooped or bent over, but present now also when he takes a deep breath. 2. A swelling in the same region. 3. Loss in weight, amounting to 25 pounds. 4. Weakness. 5. Diarrhea, with bloody stools, the latter not being verified by our laboratory. 6. Epistaxis at irregular intervals. Hematemesis is denied.

Fig. 245.—The outline of the spleen in Case I. Weight, 1310 grams. Measurements, 25 x 15 x 10 cm. (maximum thickness).

The only previous illness was during a period of four or five months, five years ago, when he had paroxyms of chills and fever. The venereal and family data are negative, and as to his personal routine there is little to note except that he smokes and drinks beer moderately. The use of whisky or gin is denied.

The physical examination shows a man of fair nourishment, considering his long illness. The scleræ convey a suggestion of icterus, though the color of the skin is hardly more than racial.

The temperature, pulse, and respiratory rates have been normal at all times since he entered the hospital.

Until the abdomen is reached the examination is entirely negative except for the presence of a few small, discrete, nontender lymph-nodes in the cervical chains. The blood-pressure readings are $\frac{152}{100}$ mm. Hg.

The spleen is enormously enlarged, causing a marked prominence in the left upper quadrant of the abdomen and the lower axilla (Fig. 245). The organ is firm and the surface smooth except for a small knob-like prominence just below the costal arch.

There is no palpable notch. Over the upper lateral aspects of the abdominal portion of the tumor a loud, rough, to-and-fro friction-rub is heard.

The liver does not appear enlarged either by palpation or percussion, and there is no free fluid in the abdomen. The balance of the physical examination is negative.

Laboratory Data.—The urine is normal in every particular. The stool is mushy, of normal color, and contains no chemical blood. The Wassermann reaction in the blood is negative. A provocative dose of neodiarsenol (0.6 gm.), followed in five days and again in ten days by Wassermann tests, produced no change in the reaction.

The hematologic examination revealed the following:

Hemoglobin, 68 per cent. (Sahli corrected).

Red blood-corpuscles: 3,930,000, the cells showing a moderate anisocytosis, with a small-celled tendency, moderate poikilocytosis, and rather pale centers.

White blood-corpuscles: 2400 (and 2600), distributed as follows:

Polynuclear neutrophils, 82 per cent.

Lymphocytes, 11 per cent.

Large mononuclear and transitional cells, 5 per cent.

Eosinophils, 2 per cent.

No malarial parasites were found.

Observation of the patient brought out one additional fact, namely, on two attempts to remove the stomach contents after a test-breakfast, there being an interval of three days between the attempts, a considerable amount of bright red blood came through the tube on each occasion. The introduction of the tube was without difficulty and could scarcely be held responsible for so large a hemorrhage. In other words, this manifestation—hematemesis—may properly be interpreted as a latent symptom.

An elaborate differential diagnosis in this case is quite unnecessary. Clinically, the picture is that of splenic anemia, which is a synonym for the initial stage of the disease first fully described by Banti and bearing his name. The occurrence, particularly in a young or middle-aged man, without discoverable

etiology, of a marked splenomegaly, associated with an anemia of the secondary type plus leukopenia and a relative lymphocytosis, and with hemorrhages from the mucous membranes, especially hematemesis—the whole exhibiting an exquisitely chronic course of three to five years or longer—is clinical justification, according to the criteria laid down by Banti, for the diagnosis of the first stage of the disease in question. With respect only to the relative lymphocytosis does our case deviate from these criteria, and there appears to be a considerable difference of opinion as to the validity of this point.

The matter of the present-day interpretation of Banti's disease I shall postpone for the moment.

In the case of the young man we are considering it appeared that the spleen was somewhat reduced in size after the first injection of neodiarsenol. For that reason, antiluetic therapy (diarsenol and mercury) was continued despite the negative Wassermann reactions. No further change was noted, however, after a month of this régime.

At another time we have discussed the indications for splenectomy in various conditions in which it has been advocated. In one process—the congenital form of hemolytic icterus—its success is admitted by all. In others, such as pernicious anemia, in which for a time the operation seemed to hold out considerable hope, splenectomy has been more or less generally condemned. In Banti's disease opinion is still divided. While the splenomegaly in the latter is not merely a symptom as it is in pernicious anemia, it is also not so definitely the site of the essential pathology as in hemolytic icterus. The spleen of the Banti's process appears to be the point at which the pathogenic agent exerts its initial and most distinctive action. The course of the disease offers convincing proof, it would seem, that the second stage of the process does not begin until the splenic changes have reached a definite level. In selected cases, therefore, there may be said to exist the *relative* indication for splenectomy in Banti's disease. As the case we have been considering seemed to fall into that category—an early one in an individual in fairly good physical condition—operation was advised.

Operation and Pathologist's Report.—The removal of the spleen was not attended with especial difficulty, although there was considerable bleeding following the separation of the abundant adhesions about the organ. The liver was found normal, the peritoneum was smooth and glistening, and there was no free fluid in the abdominal cavity.

The patient has made a good recovery, and at present—about a month after the operation—feels very comfortable. Of course, an ultimate conclusion as to the success of the procedure cannot be drawn for years. The most striking change noted in our patient has concerned the blood-picture, the leukocytes now numbering about 10,000 per c.mm., and the red blood-corpuscles having passed the 4,000,000 mark.

Our pathologist, Dr. Nuzum, has made the following report: The spleen is enormously enlarged, weighing 1310 grams, and measuring 25 cm. in length, 15 cm. in breadth, and 10 cm. in thickness at the thickest point. It presents a uniformly dark purplish-red color. The capsule is tense and smooth except for an area over the diaphragmatic surface and extending backward over the posterior border, where there is an elevated, grayish-white fibrous thickening which measures 12.5 by 7 cm.

The gastric impression is very marked. There is no notch on the anterior border of the spleen. The splenic artery and vein exhibit no thrombosis.

Microscopically, the capsule appears thickened and the trabeculæ prominent. There is a moderate degree of fibrosis of the splenic pulp. The malpighian bodies have largely disappeared, while those which remain are sclerosed or almost completely replaced by connective tissue. The venous sinuses throughout the parenchyma are hyperplastic and dilated.

Paraffin sections of the spleen were stained by Levaditi's method and with carbol fuchsin. No spirochetes or tubercle bacilli were found.

Blood from the spleen examined after the removal of the organ showed no malarial parasites.

Résumé.—We have said that the clinical diagnosis in this case could not be other than the splenic anemia stage of Banti's

disease. This diagnosis is confirmed by the anatomic examination, which shows the prevailing change to be one of fibrosis. The rather moderate degree of the latter indicates that the process is fairly early and is harmonious with the clinical history. The absence of a discoverable etiology in this case stamps it as a true Banti's disease if one is inclined to adhere to the criteria laid down by Banti himself.

CASE II.—(J. S., Patient No. 654,733, Ward 63).

As I read you the record of this second case you will note how closely, in many respects, it resembles the first; you will note, also, certain important points of difference.

This is also the case of a young man, twenty-one years old, native born, and a janitor by occupation.

His complaints are of weakness, loss of weight, dyspnea, bloody stools, diarrhea, and abdominal pain. The weakness has been progressive for the past two years, while during the same period he has lost 25 pounds in weight. Shortness of breath has been noticed for a year. The diarrhea began a little over a month ago and has lately been succeeded by severe obstipation. At first the stools were black, but of late they have contained fresh blood.

The pain is colicky and intermittent and began about the time when blood appeared in the stools. It is often severe enough to prevent sleep, and is usually relieved by a bowel movement, and, to some extent, also, by local applications of heat. Though the pain has been of maximum intensity in the left upper quadrant of the abdomen, it has been severe at times along the entire course of the colon.

There is a history, also, of an hemoptysis, amounting to ¼ tumblerful, four months ago, but we have not satisfied ourselves that the blood was not of esophageal or gastric origin. Since the patient entered the hospital he has had a number of severe attacks of epistaxis.

The anamnesis contains only one additional fact of importance, namely, that the patient is an immoderate user of alcoholic beverages.

The findings are, for the most part, normal. The patient is

slender, though fairly well nourished. There is no jaundice and no other abnormal pigmentation. No pathology is evident in the superficial groups of lymph-nodes and there is no ankle edema. The head and neck and the heart and lungs reveal no changes of significance. The blood-pressure readings are $\frac{136}{86}$ mm. Hg.

The abdomen is slightly distended and exhibits a considerable prominence in the left upper quadrant. A moderate degree of

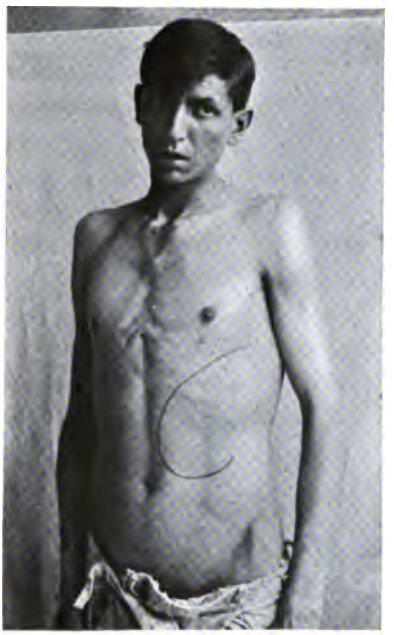

Fig. 246.—The splenomegaly in Case II. Weight, 810 grams. Dimensions, 20 x 12.5 x 9 cm. (greatest thickness).

tenderness, without rigidity, is present along the course of the large bowel, and particularly in the splenic region, where a large, smooth, rounded tumor, which moves freely with respiration, can be palpated. The size of this tumor, which presents all of the diagnostic criteria of the spleen, is shown in the photograph I have here (Fig. 246).

In this case, unlike the first, the liver seems to be somewhat enlarged, extending upward to the fifth rib and downward two

fingerbreadths below the costal arch. The consistency is somewhat firmer than the normal, there are no gross inequalities of the surface, and the edge is moderately round. There is no free fluid in the peritoneal cavity.

Inasmuch as digital examination of the rectum failed to clear up the cause of the bloody stools—the few, small, dilated hemorrhoidal veins did not seem to offer a sufficient explanation—the sigmoidoscope was passed. No pathology of significance was revealed.

The laboratory has made the following reports:

Urine: Negative in all particulars.

Stools: Normal except for the presence of chemical blood.

Wassermann reaction: In the blood, negative.

Hematologic examination:

Hemoglobin, 45 per cent.

Erythrocytes, 2,400,000, and on a second enumeration, 2,200,000. The cells showed the characteristics of a moderate secondary anemia.

Leukocytes, 2600, and on subsequent counts, 3000, 2000, 2400, 2800, distributed as follows:

Polynuclear neutrophils, 62 per cent.

Lymphocytes, 35 per cent.

Large mononuclear and transitional cells, 3 per cent.

If, for the moment, we leave out of consideration the history of alcoholism, we are fully justified, on the basis of the various data just given you, in making a diagnosis of Banti's disease in this second case, for reasons already given in the discussion of Case I. In one important respect, that of the enlargement of the liver, the second case differs from the first. On the strength of this hepatic change, still assuming that we have to do with Banti's disease, we must conclude that Case II is in the second stage of that process.

Returning now to the matter of the alcoholic history, we are forced to dismiss the possibility of Banti's disease in this young man if we adhere to the strict clinical standards laid down by Banti himself, one of the most important of which is that there must be no discoverable etiology. It is possible, of course, that

an alcoholic should develop the Banti picture and that the alcohol is incidental, not responsible. This, however, is merely begging the question.

Allow me to call your attention at this point to what may be termed the present-day conception of Banti's disease. It is pretty generally conceded that the strict clinical and pathologic criteria essential to a diagnosis laid down by Banti in his several communications can no longer be accepted in their entirety. I have already stated that splenic anemia, formerly regarded as an entity, must be incorporated into our conception of the Banti picture, of which it is the initial stage. Of more importance, perhaps, is the present tendency to regard Banti's picture not as an entity, but as a symptom-complex which may be due not only to causes not evident, but to the toxins of such conditions as syphilis, malaria, tuberculosis, and to alcohol.

This revision of the Banti formula is based upon excellent clinical and pathologic grounds. Anatomically verified cases of Banti's disease show clearly that the clinical picture is subject to considerable variation. Conversely, cases clinically fulfilling the Banti postulates prove ultimately to be due to syphilis, alcohol, malaria, etc. Nor, finally, is the pathology of cases which clinically bore every mark of the true Banti picture, including the absence of a cause, always uniform.

In brief, there exists every reason for believing that Banti's disease is not an entity, but a complex of variable origin and variable clinical picture. Hence, as suggested on several sides, it seems advisable to discontinue the use of the term "Banti's disease" and to substitute therefor a more correct application, such as the "Banti symptom-complex" or the "Banti complex."

On the basis of the history and findings of the patient under consideration and in view of what has just been said regarding the meaning of Banti's disease, I feel fully justified in making a diagnosis of the Banti complex in this second case.

From an academic point of view, however, it is interesting in this case to analyze the factors which, on the one hand, speak for the pure Banti picture and, on the other, for the diagnosis of the ordinary Laennec cirrhosis of the liver. As a matter of fact,

the clinical findings point partly in one direction, partly in the other. It is a *mixed case* and, therefore, especially instructive. The age of the patient, the marked splenomegaly, the typical blood-picture, and the hemorrhagic diathesis speak for Banti's disease in the strict sense. The history of alcoholism and the relatively short duration of the process—two years or less—speak for cirrhosis. But as we have already noted with respect to Banti's disease, and as we shall have occasion to point out later in connection with cirrhosis, the clinical pictures of both are subject to such considerable variation as to offer no safe basis for a differential diagnosis. Clinically, all that can be said, as we have already indicated, is that we have to do with a case of the Banti complex, due, perhaps, to alcohol.

This patient was also transferred to the surgical service. My recommendation was that an exploratory laparotomy be done to ascertain, if possible, the cause of the man's more or less generalized abdominal pain and his recently developed intractable constipation, manifestations which did not harmonize with either of the diagnoses mentioned above. Incidentally, it may be said, the possibility of a tuberculous peritonitis was not entirely disregarded, either as a complication of an alcoholic cirrhosis of the liver or as a process secondary to that rare form of primary tuberculosis of the spleen, described by Carbone and Auché, in which the clinical and anatomic pictures are essentially those of the Banti complex.

At operation the peritoneum was found normal and the peritoneal cavity free from fluid. Associated with the considerable splenomegaly was a moderate degree of perisplenitis. The liver was moderately enlarged and exhibited a typical hobnail surface.

Exploration, in brief, revealed no cause for the severe pain or the obstipation, and in particular eliminated tuberculous peritonitis as a possible cause for the same. As regards the pathology of chief interest to us, operation left undecided whether the case was one of Banti's disease in its second phase (using this term in its strict sense), or a Laennec cirrhosis of the liver with an unusually large spleen.

Instead of closing the abdomen at this point, the advisability

of splenectomy was considered. The question was argued from the standpoint of the diagnostic possibilities, and it was decided that whether the case was one of Banti's disease in the stage of hepatic cirrhosis without apparent etiology, or an alcoholic cirrhosis with an unusually marked splenic enlargement, the indication was present to remove the spleen upon the following grounds:

1. The age of the patient; 2, the various manifestations pointing more to the strict Banti type than to a Laennec cirrhosis; 3, the relatively short duration of the process; 4, the probability that the spleen was in some degree at least a focus of further infection; 5, the organ in its present state was of as little value in the economy as a diseased tonsil or appendix.

Kanavel[1] has well expressed the indications for splenectomy in this type of case. He has recently said: "In splenic anemia and Banti's disease, especially in their early stages, the results of splenectomy are . . . extremely encouraging. . . . In these cases (splenic anemia, Banti's disease, and the anemias secondary to syphilis, chronic sepsis, and malaria) we have to do, apparently, with an anemia resulting from a hypertrophy of the spleen, the enlargement being the consequence of a toxemia. The splenic hypertrophy is probably beneficial in limiting or destroying the primary condition, but carries with it the detrimental consequence of an abnormal destruction of the red blood-corpuscles. If the splenomegaly represents merely the aftermath of an infection which has already run its course, the removal of the organ will be sufficient to relieve the anemia.

"We can speak with less certainty of those splenic enlargements accompanying the various cirrhoses of the liver. In those cases in which it can be shown that the causative agent has *primarily* involved the spleen, benefit can be expected from operation, while in conditions in which the splenic hypertrophy is distinctly secondary to the hepatic process, little good can be expected."

The spleen was accordingly removed. The operation was attended with little hemorrhage and shock. Unfortunately,

[1] Medical Clinics of Chicago, II, 2, September, 1916, p. 414.

however, the early favorable postoperative course was interrupted on the third day by a bronchopneumonia to which the patient rapidly succumbed.

The pathologic laboratory has made the following report on the spleen from this case: Weight 810 grams; dimensions 20 by 12.5 by 9 cm. (maximum thickness). The color is the normal purplish-red hue. The capsule is tense and the splenic pulp soft and engorged with dark blood. The vessels at the hilus of the organ are not thrombosed.

Microscopically, the capsule appears of normal thickness. There is a slight increase of connective tissue—a fibrosis of the splenic pulp. The malpighian bodies appear entirely normal. The venous sinuses are hyperplastic and dilated and the cells of the parenchyma have partially disappeared, giving the appearance of empty spaces between the dilated sinuses.

No Spirochætæ pallidæ nor tubercle bacilli could be found by suitable staining methods.

A section of the liver removed after death (a complete autopsy was not permitted) shows the features characteristic of an atrophic cirrhosis.

In the light of generally accepted criteria the anatomic findings in this case offer a no more satisfactory solution of the exact nature of the process than do the clinical. We may still speak of it as a "mixed" case. The moderate degree of fibrosis is common both to the Laennec type of cirrhosis and to early cases of Banti's disease. The evidence of stasis suggests the spleen of cirrhosis; the absence of the characteristic hyperplasia of the pulp speaks against cirrhosis. The size of the spleen, while unusual for the alcoholic cirrhosis, is by no means impossible in the same.

I believe that the data furnished by these two cases into which we have entered in so great detail show very conclusively the close relationship existing between Banti's disease, *sensu strictu*, and the Laennec type of hepatic cirrhosis. This is the impression I wish you to carry away from the discussion of these records. A great many observers go a step further and maintain that the two conditions are essentially one process, the toxic agent in one

affecting primarily and predominantly the spleen, and in the other the liver and spleen simultaneously and more or less equally.

This conception leads us directly to what I have called the incidental part of my theme—the problem of the cirrhoses as a whole from the point of view of the splenic and hepatic changes in the same. The following considerations will assist us in arriving at a solution of this problem:

1. On the basis of the material already given you we may, without undue assumption, classify splenic anemia and Banti's disease under the cirrhoses of the liver. In our further discussion, therefore, the two conditions will, with certain exceptions, be considered together.

2. Just as Banti's disease—strictly interpreted—and Laennec's cirrhosis merge into one another, so do the Laennec and the Hanot types of cirrhosis exhibit mixed or transitional forms. These mixed types, which are not at all infrequent, though given scant attention in your texts, resemble the Laennec cirrhosis in their alcoholic history and age incidence, and the Hanot cirrhosis, particularly in the matter of a very large spleen and the occurrence of icterus. Clinically, the liver is variable; anatomically, it exhibits characteristics of both the alcoholic and biliary cirrhosis.

3. Just as there are cases which may be regarded as representing transitions between Banti's disease and the Laennec type of cirrhosis, and further between the hobnail and the Hanot types, so may cases of the latter approach closely the clinical and anatomic pictures of Banti's disease. The age of the patients, an unusually large spleen, icterus, hemorrhages, and a degree of fibrosis not usually found in the cirrhotic spleen are the findings which bridge the two processes.

4. As to the spleen in the various conditions under consideration, it may be said that although a moderately enlarged organ is the usual thing in alcoholic cirrhosis, an enormous spleen in Banti's disease and a spleen of intermediate size in Hanot's cirrhosis, yet the variations from this rule observed in anatomically verified cases are considerable. Thus, in this particular also,

there exists no absolute criterion by which the conditions may be distinguished.

As regards the spleen, further, the emphasis formerly placed upon the rôle of stasis in causing the splenomegalies of the cirrhosis has gradually given way to the opinion now almost universally held that the enlargement is due equally, if not predominantly, to the action of the hypothetic toxin held responsible for the cirrhotic process as a whole. This conception establishes another point of contact between the spleen of the cirrhosis and that of Banti's disease.

5. With respect to the matter of jaundice, no significant data can be offered. In the Laennec cirrhosis and in Banti's disease the degree of icterus is usually slight, while in Hanot's cirrhosis the subicteric level is disturbed periodically by summits of intense, though not acholic, jaundice. As a variation of this rule, however, we have been impressed by the frequency of jaundice, of no mean degree, in the Laennec type, due, probably, to the same factors which are responsible in the hypertrophic form, namely, a cholangitis and possibly changes in the liver parenchyma itself.

6. Too great emphasis has been laid perhaps upon the blood-picture in the splenic anemia phase of Banti's disease. It is not at all an uncommon thing to find a marked leukopenia and an anemia of the secondary type in undoubted cases of hepatic cirrhosis. There is a case of the latter in my service at present with 3000 white blood-corpuscles to the cubic millimeter, an erythrocyte count of 3,500,000, and a hemoglobin of 60.

7. Hemorrhages from the gastro-intestinal tract are common to all of the conditions we are considering.

These are some of the more important facts which render so difficult a classification of the cirrhoses on clinical or anatomic grounds. Indeed, observers are in accord in pointing out that no satisfactory classification is to be hoped for until one can be constructed on an etiologic basis.

To me the problem seems less difficult of understanding if regarded in some such light as this: The cirrhoses of the liver, splenic anemia, and Banti's disease, together with the many mixed forms we have considered, are all manifestations of one

large process. The type assumed in the individual case depends upon factors imperfectly understood, but which, from analogy with pathologic processes more fully analyzed, may be assumed to be the nature and mode of action of the responsible agent and the resistance of the individual as an entity and as regards certain of his organs (spleen, liver, etc.).

This responsible agent is generally supposed to be of the nature of a toxin, in many cases unknown—possibly a metabolic by-product—in others known (syphilis, malaria, tuberculosis, alcohol—the latter directly, or indirectly, by creating conditions favorable to the production of metabolic poisons). In one case the initial and predominant action of the etiologic agent is exerted on the spleen; in another, more or less equally and simultaneously, on the liver and spleen; and in still others primarily on the liver. The transitional types spoken of would be interpreted along similar lines.

This conception, while based partly upon theory, has much of fact in its favor, and seems to offer the best explanation, at present available, of this difficult problem.

CLINIC OF DR. RALPH C. HAMILL

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INSOMNIA

LYING awake at night seems to possess more terrors for the adult human than almost any other departure from the normal. Failure of sleep, or insomnia, doubtless has many different causes or, to put it better, many things contribute to the restlessness, nervousness, worry, etc., that keep people awake. I want to tell you of a case whom, unfortunately, I cannot demonstrate, but, after all, demonstration of such cases is not of great importance.

The case is that of a physician who is about forty, and who has had a hard battle to fight all his life. There are many elements in this battle that I do not feel entirely free to mention, or at least to dwell upon. One of the elements which make the battle hard is not one that a person would ordinarily be inclined to take into consideration. It is the fact that he graduated from an inferior medical school. That is, he did not have adequate preparation upon which to base his life-work. Also, he was married to a young woman who was mentally deficient and who has made a great deal of trouble for him. This trouble is an interesting part of the problem to evaluate.

To digress a little, I must ask you to appreciate the fact that, after all, we humans are essentially egoistic, that is, essentially selfish, so that any interference with our progress necessarily causes trouble in our minds, bringing up a conflict between the natural selfishness which demands our doing our best for ourselves, and the more cultured attitude which demands self-sacrifice and our doing our utmost for the sick and inefficient.

This man, then, had that problem to wrestle with, namely, a realization that the person he was married to was a liability

rather than an asset. That he lost instead of gained every day that he had to live with her. After wrestling with his problems for a few years he began to sleep poorly, and in order to do his work the next day he felt it was absolutely essential that he get a good night's sleep. In order to get this sleep he commenced to take drugs. He used veronal, trional, sulfonal, bromids, and all the rest of the sedatives except opium, until he ceased to be able to get any satisfaction from them. Then he turned to alcohol. At first he used a small amount of beer, but gradually increased the amount, and then found that it knocked his stomach out, and so turned to whisky. For the last few years he had been using a constantly increasing amount of whisky in order to secure unbroken slumber. This amount had finally gotten so large that he felt the effects the next day in a slowing down of his mental capacity, and he realized that the time had come when he had to break with whisky. Consequently, he consulted me with this tale to tell.

What was to be done for this doctor? What were his problems? First and foremost was a belief that in order to do his work creditably he had to have sleep; stated differently, his work and the excellence of its performance is the all-important factor, and this gives us a suggestion of that which I have already spoken of, namely, the natural, egoistic, selfish foundation of our behavior. His work, his success is the important thing. That is the first element of his problem. It seems to me that the first element of my problem is to straighten this one out. To do this I have to determine as best I can what sleep really is and what it does, and also, what is more important, the patient must see his needs and understand them. He must understand why he thinks sleep is so essential.

I think we can readily appreciate, at least those of us who are old enough, that so far as the physical side is concerned—the physical fatigue—sleep is not nearly so essential to the ordinary adult of thirty or more years as it is to the younger person. That is, we do not take sufficient physical exercise, we do not exercise so much, but that we can get a rest by simply lying still sufficient to put us on our feet the next day. We do not expend anywhere

near as much physical energy as we do when we are younger. Consequently, I cannot believe that unconsciousness with its still-lying or absolute quiet is an essential. On the contrary, we adults have much need for mental relaxation, or at least our daily problems are more difficult than those of the adolescent. The moderately successful adult has to coerce and drive his mind along a single-track road practically all day long if that moderate degree of success is to be continued. The more successful he is, the more single tracked the road. It is not so difficult to keep one's mind on the track if the attendant circumstances are in favor of doing so. The attendant circumstances are the character of the mind—that is to say, its fitness for the task, the degree of interest with which the mind takes up its work, which, to be sure, is somewhat dependent upon the fitness, and somewhat dependent upon this interest, the number of distractions that attempt to side-track, switch, or wreck this single-tracked progress. We are all agreed that "all work and no play makes Jack a dull boy." We have always said that vacations are absolutely necessary. Consequently, I am inclined to think that sleep is very little more than a daily vacation from these driving powers of our concentration or attention, will power, memory, or what you will. Sleep is really a departure into vacation fields of the tired out mentality. It is tired out, as I have pointed out, in proportion to the difficulty of its tasks, and this difficulty is dependent not upon the tasks alone, but upon many additional attributes.

In this case the inferior alma mater, the inferior preparation, was sure to make for difficulty. This man is an unusually conscientious, ambitious man. He was tremendously driven by the necessity of doing well by his patients, consequently it was much harder for him to practice medicine than it would have been if either his education had been better or his conscience tougher. All this I laid before the doctor.

It seems to be an inevitable impulse of the human mind to look for cause, and when we suffer it is almost inevitable that we should think that the suffering comes as a form of punishment of some variety. We see this expressed in all sorts of ways

—"Why should I have to suffer this way?" "Mary always went to church; she was the best woman in the world, why did this overtake her?" etc.—we hear it on all sides every day. How does this apply to our patient? He suffers, he lies awake, he is more or less unhappy. He has a problem on his hands that almost demands independent, egoistic action, and yet, on the other hand, demands much of self-sacrifice. A man has so much energy to expend and no more, so much time to devote and no more. For the reasons cited above, time and energy were demanded by both his practice and his wife in such a degree that drive himself though he would still he could not do enough to satisfy himself. He had to try to strike a balance somewhere between these two extremes of egoistic action and self-sacrifice. It would be surprising indeed if self-sacrifice ruled entirely. Consequently, here alone we see possible cause of self-condemnation —he does not give up as much as he might for the benefit of the mentally deficient wife. Perhaps the most frequent thought of blame that occurs to those who suffer functionally in a nervous way is the thought of how disastrous the effects of masturbation may have been. The thought that masturbation will be followed in later years by insanity, "loss of manhood," nervousness, etc., has been well sown in fertile ground by quacks, patent medicine houses, and oversolicitous elders. And so, as this man's difficulties increased and his mind became more and more unsettled as to what should be done, he commenced to doubt himself, to lose his self-confidence. His memory wasn't so good—of course no one's is who is worried and harassed. He became irritable, which was not creditable. There undoubtedly were moments, if not longer periods, when he began to wonder if insanity might not be his fate. You will remember that he was living with it and in apprehension of what it might do to him through his wife.

This fear of insanity, loss of mental control, is perhaps the most insidious as well as the most wide-spread of the fears of our fellow-men. They do not like to own up to it, so the physician frequently must ask directly whether it is present or not. Then he must do his utmost to explain its genesis. If he can do

this, in the majority of cases the patient's relief is at once apparent.

This man's wife belonged to a very religious family, a fact that is not without importance. The belief in sin was active enough in his environment, at least, if not in his own mental make-up. All this side of the problem, namely, the side of sin and punishment, had to be laid before him so that he could see in the open things that he might allow himself to barely glimpse or suspect after dark.

About two years ago a man fifty-five years old consulted me with very much the same story, except that the element of the mentally enfeebled wife was not present. Business difficulties, the fear of failure, of business inefficiency, and an insomnia that had lasted for twelve years were the principles of his complaint. For the past twelve years he had been depending upon whisky for his rest. He was thoroughly convinced that he had to have sleep in order to be able to work the next day, and he felt certain that he could not sleep without whisky. He had started in moderately, as had the first man, but had gradually increased the amount until at the time he consulted me he was drinking over a quart a day. Of course he was feeling it physically. He had gradually gotten to a point where he had to have a drink in the morning to brace him up, another drink at noon to carry him along, and in the middle of the afternoon he commenced to prepare for slumber. One might have said that he was obsessed with the idea that he would not sleep, or one might have gone still further and said that he wanted to be obsessed by this in order to have a good excuse to drink. There is more about this point than appears at first sight. Whisky, as you probably know, gives a person a certain feeling of efficiency; it lessens our self-condemnation and self-criticism and increases our egotism. It has a certain power to diminish our feelings of inadequacy. In this sense it is a natural substitute for a condition of sleep, because in our sleep we shut out all the distracting, overwhelming, overbearing, superior forces of the outside world. With these shut out we are master of all we survey. So, as I say, whisky

and sleep are natural partners. This man was taking sufficient whisky during the day so that there was very little danger of signs of his inadequacy overtaking him.

To this man I told the foregoing beliefs concerning sleep. Also, my belief that he would be able to work in spite of the fact that he had no sleep. I then told him to cut out the whisky entirely, go out after supper and take a good brisk walk for half an hour, then go home and take a warm bath for fifteen minutes, go to bed and lie there, and think of all the good times he had ever had, and when the pressure got too great merely turn over on his face and let nature take care of the rest. I also gave him some 15-grain sodium bromid tablets. He did not know what they were. He was to take one after breakfast and lunch and two after supper and at bedtime. The next day he called me up to tell me that the scheme worked perfectly. This after twelve years of whisky as the only possible means of sleep.

I will not attempt to determine the exact value of correcting the attitude of the patient toward the whole matter of sleep as against the value of the drug—the sodium bromid. In the case of the doctor no drug was used, and yet the simple procedures succeeded. With the older man, the second patient, sodium bromid may have had some effect. He had had 60 grains when he went to bed the first night. I would rather say that the two procedures, the talk and the drug, aided each other in their actions. Sodium bromid in good-sized doses certainly has a quieting effect. The patient has been reasoned with and made, or at least the attempt has been made, to have him take a reasonable attitude toward his problems. He is assured that he will sleep all right if he takes such a reasonable attitude. He goes to bed slightly fatigued physically from his walk after supper, which he thinks he knows is a healthy thing to do. His fears are somewhat quieted by the reassurances of the physician. He sleeps, and he certainly is not sure that the changed attitude is not the cause of his sleeping. If it is, then, in a sense, it is his own doing. That makes for increased self-confidence, and that is really what we want for the patient.

To return to my doctor. I gave him much the same directions, and because it was very cold weather when I saw him I directed him to crawl in between blankets instead of cold sheets. He reported to me the next day that a most astonishing thing had occurred. He had gone to bed at 9 o'clock, had immediately gone to sleep, and the next thing he knew it was 11 o'clock the next morning.

As I have said, he was given no drug and yet he slept as he hadn't slept for a long, long time. Consequently we can say without reserve that it was the changed attitude with him that brought the sleep. Suppose we say for a moment that it is his confidence in me that worked the cure. I will admit that in any therapeutic procedure a generous discount must be allowed for just this thing: The patient's faith in the physician. Now if the physician sticks to truth with his patient, then isn't it reasonable to expect that the patient, sensing the truth, will come to take a more reasonable and less emotional attitude toward his difficulties? If the truth is told, *i. e.*, in a general way, it is apprehension that keeps the patient awake and the fears are groundless; if that is fully grasped by the patient then he can handle the situation himself, and that is what works for a permanent cure. All the man needs is to feel that he is in control of the situation. If he can feel that, instead of fearing that the situation threatens to overwhelm him, then he sleeps. One might say that having self-confidence he does not fear to close his eyes.

HYSTERIA

HYSTERIA is not a disease. It is an indefinable state of mind which is the result of a combination of inherent tendencies mediated by difficulties of environment during the early years of life. There is perhaps, however, one fundamental thing about hysteria that is true of the other psychoneuroses, namely, that there is a large element of apprehension common to all these states of mind. The common name for apprehension is fear. Fear has certain definite subjective symptoms; not altogether subjective either, since one of them, rapid thumping pulsation, is detectable by the examiner's finger.

The symptoms of fear, briefly stated, are, first of all, a sense of oppression in the cardiac region with immediately a rapid pulse, which is felt by the chest wall and is described ordinarily as palpitation. At the same time that this palpitation comes on a sense of gripping or thickness in the throat begins, induced perhaps by the aforementioned change in the circulatory system. This is ordinarily spoken of as "My heart is in my mouth." In scientific terms it is described as a definite symptom, the globus hystericus. There is a sinking sensation in the region of the diaphragm which perhaps has to do with the change of blood distribution; that is, a contraction of the splanchnics that comes on almost immediately. There is a sense of giddiness which is also probably a vascular phenomenon.

Other symptoms of fear are cold hands and feet, hot head, weakness of the knees, and general feeling of weakness and lassitude. These are some of the subjective sensations, the physical symptoms of fear or apprehension, and I think one is perfectly safe in saying that fear is always present in the psychoneuroses.

Just what this fear is, what its origin is, is a matter for speculation, but is certainly not determinable according to our present knowledge. Anyone who attempts to explain it has never observed it in the very young for instance, where it seems, beyond

the peradventure of a doubt, to be something inherent rather than anything to be explained by environmental conditions; that is, by things that we can observe, analyze, and understand. We can say that each individual is apprehensive concerning the outcome of the conflict that exists in all of us between the pleasure-loving, self-gratifying desires that are typical of the child and the more purposeful far-reaching teleologic motives of the adult; of the outcome of the conflict of which perhaps none of us are conscious unless we stop and carefully study ourselves, but a conflict which exists nevertheless. As I say, it may be that that is the cause for apprehension in the adult—fear lest the impulse to satisfy the desire for immediate pleasure overcomes the other motives by which the people among whom we live and we ourselves also judge our conduct.

Leaving for the present this subject of whence and why the fear, and accepting the fact that fear is present in the psychoneuroses, some of the symptoms of the latter become a little more understandable. The case I will show you today is one of those in which the predominant symptoms relate to the abdomen, and yet in which the other manifestations of apprehension are also detectable.

This woman, who is twenty-five years of age, has vomited for the past ten months. She has lost 70 pounds in weight; she vomits practically everything she takes into her stomach after a period of an hour or two. There is a certain amount of tenderness over the epigastrium which might lead to a suspicion of organic disease, but I think is nothing more than an exaggeration of the normal tenderness that all of us have in this particular region. Gastric analyses, analysis of feces, blood and sputum analysis, temperature chart—none of these things throw any light on the genesis of this condition. Everything is perfectly normal and yet the vomiting keeps up. There has just been a change of doctors, and the patient has shown new symptoms. For the past few weeks she has been manipulating her diaphragm in such an extraordinary way that it seems almost unbelievable. There are periods when she will keep it in almost a vibratory motion for as long as fifteen to twenty minutes at a time, moving

it through such an amplitude that it moves her whole chest, so that one can scarcely make out respiratory movement independent of this diaphragmatic "tremor," and yet such respiratory movement is present and is not hurried. There have been times during these past few weeks when instead of this rapid, fluctuating movement of the diaphragm the latter has been held in spasm in such a way as to force the abdominal contents downward and forward, giving an appearance of abdominal tumor. These motor phenomena of the diaphragm have been quite independent of the vomiting, and I have been able to stop them by electricity and suggestion. These are not means that I am proud to use in a case of this sort except as they help to establish the diagnosis. I would much prefer getting the patient to realize that motor control can be practised beneficially as well as in this pathologic manner; that is, the "tremor" and "spasm."

This woman's previous history is interesting, as it throws a light on the genesis of this functional condition. It is difficult to get anything about her early childhood, much as it is to be desired. In fact, the first that I can get begins with the onset of puberty, except that she says that her mother was one never to talk "such things" over with her daughters. So this girl went to bed one night when she was thirteen years old entirely ignorant of what was to happen, and woke up in the middle of the night terrified to find the menses established. She was so frightened that she dared not call out, but got up and vomited. She has vomited with every menstrual period since. She is a Roman Catholic and very religious. In other words, she has a very marked feeling relative to sin, and it can be assumed without question that this that had happened during the night came as a punishment for previous sins.

It is to be noticed as I talk to her and as she presents herself that she constantly grins in a silly manner, is quite affected, and fails to express in her conduct the seriousness of her condition. This is an entirely different silliness from that seen in dementia præcox, where the silliness is more as if the patient had some joke of which they alone were cognizant that they were enjoying. In this case it is more a self-consciousness. One might

say that she wished to minimize the seriousness of her condition. This is an important point in the understanding of an hysteric. It belongs among the phenomena ascribable to splitting of consciousness. If we could define it we would say something to the effect that she wished to impress the on-looker with the seriousness of her condition, but did not wish to appear impressed herself.

I have had many interviews with the patient, and she has never expressed an idea of seriousness connected with the vomiting. She has never expressed dissatisfaction at the failure to cure or relieve. This in itself is extraordinary when we remember that the patient has been vomiting for ten months.

The general neurologic examination is negative. The reflexes are normal. I have not made sensory examinations because I have not wished to saddle the patient with sensory disturbances; that is, I am afraid to make sensory examination in a case like this lest the patient should grow to feel that sensory disturbance is to be expected, and so develop some one of the bizarre anesthesias of hysteria. I have assumed that this is hysteria. You might well ask why I am justified in the assumption that anybody would punish himself as severely as this patient has.

Perhaps I must explain this last remark—"why anybody would punish himself." Hysteria is essentially a disorder from within out. By that I mean there is no outside influence, such as microorganisms, climatic, dietetic, that is responsible for the genesis of the condition. It is a condition of the individual entirely independent from the environment. I think it would not be going too far to say that if this particular individual were in an atmosphere of perfect health she would nevertheless develop pathologic symptoms. She would develop a picture of disease. This is something which I must repeat, because the understanding of this factor is absolutely necessary to any step toward the understanding of the neuroses. They are from within. I will not say that is equivalent to calling them psychogenic. At any rate, we can feel fairly safe in saying that if the psyche or mental state of the individual was not such as it is the neurosis would not be developed, no matter what the other factors are. At least to

that degree the neurosis is psychogenic, and if there is a true "within," that term can be applied best to the psyche.

It is very difficult to learn anything about this patient's attitude of mind. She meets every question with "What's that got to do with it?" or she laughs and turns her face away. This much, however, I have learned, which sheds some light on our problem. She has been steadily at work ever since her school days helping in the financial arrangements of the family. Her younger sister worked only a year before marrying. As these facts were recited it was obvious that the patient felt a distinct resentment against the younger sister for shirking the responsibility. There is an additional factor which is represented by the small solitaire diamond on the left ring-finger. One might say that if this patient had enough nerve to get married she would have done so; that is, she has the chance. There is a young man waiting for her. If she is resentful against her sister for marrying, we are justified in assuming that she would marry also if there was not some deterring factor. I have attempted to discuss marriage with her, but her attitude toward this subject is the same as that toward her sickness—an obvious attempt to minimize the importance of the question under discussion.

You may well ask what this has to do with eleven months of vomiting, and with the meager information at my disposal I can only remind you that the vomiting began with the first menstual period, and that she has vomited with each menstrual period since. No one will deny that there is a closer relation between menstruation and marriage than merely that indicated by the fact that they both begin with "m." Also, resentment is to some natures that which lends spice to life. To carry a grouch and to vent one's spite upon others is a form of enjoyment that we have all observed. Whether the younger sister associates the patient's illness with her own disloyalty to the economic needs of the family or not is immaterial. If the patient senses any such relationship, that is sufficient, and there is a certain amount of evidence that the patient blames her illness on the fact that she has had to work so steadily. Naturally, if the sister had not married, but had done her duty as the patient

has, the patient would not have had to keep her nose to the grindstone.

In arriving at the diagnosis all these factors must be taken into consideration, but what was more important was the fact that when I first took the case she promptly began the terpsichorean manipulation of her diaphragm, which subsided without marked obstinacy to electricity and suggestion. Vomiting is a function of the stomach; the stomach lies immediately below the diaphragm. I am certain that vomiting would be no more difficult to produce voluntarily than the daily diaphragmatic gyrations indulged in by the patient. I stated at the beginning of the hour that I was dissatisfied with the methods used to rid the patient of these diaphragmatic symptoms. My dissatisfaction was based on the fact that a permanent cure, if there is such a thing, would be much more desirable through the voluntary co-operation of the patient than by these other methods.

I had some experiences with the enlisted personnel in the army that demonstrated this fact very clearly. Several of the men were suffering from convulsions. These were reported to me, and I inquired of the soldier just how he felt when the convulsion was coming on. In a most sympathetic manner I suggested to him by questions that he was feeling that way now—persuaded him that he was feeling "light-headed," or "slightly nauseated," etc. From this it was a mere step to producing a convulsion. As soon as the convulsion was well under way I would slap the patient sharply once or twice in the face and tell him to stop. I would then give him a lecture, dwelling on the fact that he had voluntary control of these phenomena. In some cases, at least, it was apparent that the demonstration to the soldier's satisfaction that the control of the situation was in his hands relieved him of further needs in that direction.

These measures sound rough—perhaps they are, but there is a necessity of producing a definite effect, and I know of no better way. The effect justifies the means. Of course, one cannot slap a woman out of an hysteric vomiting. I made the effort, however, to put before her a picture of her reactions toward herself such as would enable her to see that she had certain

reasons for producing symptoms of sickness. Naturally, the idea is offensive to anyone that they are suspected of attempts of any sort to elicit sympathy. The hysteric is, because of his weakness, especially unable to reconcile himself to such an idea. He is the last one to admit that any of his symptoms could be for the purpose of excusing himself either to himself or to others for the failure to make good. I have not been able to get this patient to stop vomiting as I was to get her to stop the diaphragmatic motions. I have taken up the various factors that might affect her, dwelling upon the part of the history that includes the vomiting at the time of the first menstrual period, and emphasizing the fact that vomiting recurred with each succeeding period; emphasizing also the fact that this present long-continued attack began at the time of menstruation. It is my hope and expectation that gradually the interrelation of the various facts known and unknown in her mind will take place in such a manner as to lead her to no longer feel the necessity of keeping up this defense against the outer world. When this time comes she will stop vomiting. It may come as a result of a transfer of interest to something more compelling. It may come merely as a result of fatigue; the idea will have played out.

This vomiting is an hysteric phenomenon. It has kept up for ten months. The long duration of its continuance must not be allowed to speak against its hysteric nature in spite of the teaching that the pathognomonic characteristic of hysteric phenomena is their evanescence. The hysteric symptom is the particular reaction of the patient at the moment. It does not seem to me at all necessary that that reaction must change frequently. Consequently, I feel that the permanence of the symptom does not count against its being considered of hysteric origin.

Note.—The patient has been seen recently, three weeks after leaving the hospital. She is up and around, is very much better, and vomits but rarely.

CLINIC OF DR. ISAAC A. ABT

MICHAEL REESE HOSPITAL (SARAH MORRIS MEMORIAL HOSPITAL FOR CHILDREN)

ASTHMA IN CHILDREN

THE first case that I present to you this morning is a child, W. K., male, six and a half years old, who came to the hospital February 3, 1918, with the following history:

He has been suffering from frequent attacks of bronchitis, with marked dyspnea, associated with vomiting. The father thinks they are brought on by indiscretions in diet. The first attack, which occurred four years ago, followed upon eating a portion of an egg. The symptoms noted at the time were cyanosis and dyspnea, occurring at night, accompanied by great restlessness, nausea, and vomiting. It is thought that similar attacks occurred after eating fish. Both of these articles, therefore, have been excluded from the diet. The attacks, nevertheless, occur at intervals, coming on especially at night about a half hour after going to bed, and last about ten minutes. They are associated with coughing. At the end of the seizure the patient usually vomits. The dyspneic attacks occur frequently while he is at school. When the little fellow was six months old he had a severe attack of eczema. At three he had whooping-cough. The mother states that she herself invariably has a rash after eating strawberries or after some indiscretion in diet. The father, who is a physician, is in good health.

The physical examination of the chest shows an emphysematous condition of the lungs. The heart is slightly dilated to the right. The examination of the blood shows 85 per cent. hemoglobin; 4,670,000 red cells; 9400 white blood-cells, of which 53 are polymorphonuclear, 38 small mononuclears, 5 large mononuclears, and 4 eosinophils. Tuberculin tests are negative. The

x-ray examination of the thorax shows some increased calcification at the hilus. The right lung shows some striations extending out to the periphery, which probably indicate a chronic bronchitis.

The story contained in this case record is one that is frequently encountered. Numerous histories might be taken from the records of the hospital which would simply be repetitions of the foregoing. The history here cited is obviously one of bronchial asthma; and it is to this disease, particularly as it occurs in infancy and childhood, that I wish to direct your attention this morning. If time permits I shall read you some additional histories to amplify the clinical descriptions.

Asthma is characterized by attacks of severe spasmodic dyspnea which may be preceded, accompanied, or followed by a bronchitis of varying degrees of severity. In infancy the association of asthma with bronchitis is a very close one. In older children the disease presents quite another clinical picture which differs in no essential points from the asthma of adults.

So far as the age incidence is concerned, LaFétra tells us that in 3 cases the symptoms were noted at birth. During the first three months of life he noted 2 cases; from the third to the sixth month, 3 cases; and from the sixth to the twelfth month of life, 3 cases. During the second year he had 8 cases; from the second to the fifth year, 9 cases; and from the fifth to the twelfth year, 15 cases.

Not infrequently there is a familial occurrence of the disease. It is not uncommon to be told by the mother or father that several children are asthmatic, or to be informed that the disease has existed in some other member of the family.

It is important to emphasize the fact that the infantile asthma differs from the type that occurs in adults and older children. For this reason the disease is often unrecognized in infancy. I have not infrequently observed well-developed cases of asthma that were diagnosed as bronchitis or even as bronchopneumonia.

It is often stated that asthma is more common in boys than in girls. It occurs among children of all classes, particularly among the well-to-do, especially those with neuropathic tend-

encies. It may occur at any season. It is very frequent during the fall and winter, when grip and bronchitis are prevalent, and it is also apt to appear in summer during the hay-fever season. It is interesting to note that children who are sent from severe winter weather into climates that are warm and dry tend either to improve markedly or at least to recover temporarily. I have in mind an infant who was suffering severely from asthma during the time that the family lived along the shore of Lake Michigan, who showed marked improvement after he had been removed to a home some five or six miles inland.

The effect of locality illustrates the capriciousness of the disease. Some patients do best in a dry place, while others avoid the ailment by living in a moist atmosphere. Knopf, who examined 5000 children at the Strassburg Polyclinic and found among them no cases of asthma, attributes the absence of the disease to the moist air of that region. To some patients the high locality affords relief, while to others relief comes only in a low region. In some the disease is relieved by remaining inland; in others, by dwelling at the seaside. It is noted at times that patients become asthmatic only when they visit a particular locality, and that at other times they are free from the disease only when they visit another particular locality. Sometimes an asthmatic patient can live on one street of a town and not on another. Health and disease may be a matter of living in different parts of the same house. Occupying one room the patient is free of asthma; in another, he succumbs to it. In short, it seems impossible to lay down any definite rule as to the influence of locality on the disease. It occurs everywhere, in all places and in all climates, in rural as well as in urban districts, in the mountains as well as at the sea level.

The same capriciousness is evident in the influence of the seasonal changes. One case grows worse only in winter; another, only in summer. It has already been stated that climatic conditions which predispose children to grippal infections and bronchitis also produce asthma. Almost in the same breath I may state that I have frequently seen children with severe attacks of the disease in the hot, dry spell of the summer,

when the dry heat produces new patches of eczema as well as asthma.

Much interest attaches to the exciting causes of asthma. As in most diseases which are of obscure origin, numerous hypotheses are offered as to etiology. There are some who believe that bacteria or their toxins may have some influence in the production of the disease. Koessler and Moody made an extensive study of the bacterial flora of the sputum of asthmatics. In 28 cases that they investigated they found, in addition to the aërobic organisms, the pneumococcus, streptococcus, influenza bacillus, Micrococcus catarrhalis, and certain anaërobic bacteria which they classified under three heads: "(1) A Gram-negative fusiform-like bacillus which produces a putrefactive odor in the culture, (2) A Gram-negative, very small bacillus which produces characteristic black colonies in the blood-agar, and (3) a very small streptococcus. These three organisms live in a certain form of symbiosis and are in every case present in the anaërobic tube."

The authors also state that they find a certain form of "asthma bronchitis due to the *tubercle bacillus* which can only be demonstrated by guinea-pig inoculation. Berkhart found tubercle bacilli in 5 cases. Others report similar findings."

It has been held that asthma may be the expression of an anaphylactic reaction to certain bacterial poisons; yet if autogenous vaccines containing the proteins which caused the anaphylaxis be injected, an attack of asthma does not follow. If the bronchial musculature in man acts the same as it does in a guinea-pig, a second injection of protein, even though it be small, should produce a spasm of the bronchial musculature, just as it does in the guinea-pig. This reaction, however, does not occur. Children, it may be said, are more apt to exhibit anaphylactic phenomena than adults. This increased susceptibility is due either to the greater absorptive power of the gastric mucous membrane in children, or to the acquisition of a partial immunity by adults.

The work of Talbot, Walker, Oscar Schloss, Goodale, Cook, and others have taught us that a certain group of children are susceptible to the toxic effects produced by eggs and other pro-

tein substances. These toxic symptoms are in the nature of anaphylaxis. Thus when a foreign protein is administered the body seems sensitized, and a subsequent dose of the same protein causes symptoms of anaphylaxis. Talbot tells us, however, that an injury to the intestinal mucosa is necessary in most cases before the reaction can take place, and that the greater the injury and the younger the infant, the more easily can the foreign protein pass through. It may be even assumed that in young infants the protein may permeate an intact mucous membrane. It is obvious, therefore, that sensitization can be most readily accomplished in early childhood. Thus an infant may be rendered susceptible to the toxins produced by proteins because of an inherited tendency to anaphylaxis; or it may become sensitized through an insult to the alimentary tract occurring either during the first days of life or late in infancy. It may be said, then, that in some infants and children asthma is a manifestation of anaphylaxis produced by protein substances which act as toxins.

I have frequently seen children in private as well as in hospital practice in whom attacks would be produced by the ingestion of egg-albumen. In one of the patients, a little girl of seven, who suffered from recurrent seizures of asthma, an immediate attack could be produced by ingesting the minutest portion of egg contained in cake, in bread, or in any other article of food. This child also responded to the skin test. If a minute portion of egg-white was placed on the skin, and the integument abraded with a scarifier, an intense localized urticarial reaction would occur in a few moments. It should be noted in connection with this case that a patient sensitive to one protein is very likely to become sensitive to others. In this instance the asthma would occur in response to a variety of causes. Other protein substances were capable of producing an attack, such as pollen of plants, nuts, and the emanations from certain animals. Milk may occasionally affect certain individuals in the same way.

It should be noted that the foreign protein may enter the body in various ways. It may pass through the mucous membrane by inhalation, by ingestion, or by autolysis of bacterial proteins coming in contact with mucous surfaces. The method

of entrance by inhalation may be seasonal or perennial. Seasonal inhalation, or hay-fever, produces symptoms at a definite time, coinciding with the flowering of special plants; while in perennial inhalation the exciting protein enters the body at any time and may produce asthmatic attacks. The emanations from horses, dogs, and cats are examples of this variety. Patients who are sensitized to animal substances, such as epidermal scales, hairs of animals, or feathers of birds, may show a group of symptoms varying from rhinitis to a severe asthma. Asthma may be caused also by vegetable substances in which the exciting protein is other than the pollen; for example, flour, potato, face-powder, or powdered orris root.

Various substances, such as fish, eggs, milk, meat, grains, cocoa, or nuts, may produce symptoms which vary from tickling in the throat to urticaria, asthma, or eczema. There is also a form of vasomotor disturbance in which the protein is bacterial. Walker has shown in examining the sputum of asthmatic patients that a diphtheroid organism is often found, and that the Staphylococcus pyogenes aureus is of very frequent occurrence. Whether these organisms act directly by producing irritation and inflammation of the mucous membrane, or indirectly by liberating protein substances which may be absorbed as foreign albumins, has not been definitely settled. If it can be affirmed that definite sensitization to micro-organisms exists, it is obvious that the use of vaccines would be valuable in treatment.

Relation of Asthma to Exudative Diathesis.—A group of clinicians, foremost among whom is Czerny, have attempted to explain a certain clinical entity under the caption of "exudative diathesis." It is known clinically that asthmatic individuals, particularly children, may suffer not only from disorders of the bronchi, but from other organs as well. On the basis of clinical observations, it is attempted to establish a connection between asthma and exudative processes, such as eczema and urticaria. Czerny defines the exudative diathesis as a change in the chemistry of the organism which is caused by a congenitally low tolerance to fat. In considering exudative diathesis as it affects the respiratory tract, he compares it to measles. This

latter disease produces an exanthem and an enanthem. The exanthem may be compared to eczema; the enanthem, to the catarrhal symptoms of nose, throat, and bronchi which occur so commonly in exudative diathesis. Continuing, he says that if an infant shows neuropathic tendencies or is hyperexcitable, the mild picture of bronchitis will be substituted by the more alarming condition of asthma. Again, comparing asthma to affections of the external skin, he believes that the same nervousness which tends to produce asthma will produce the intense itching in an eczema; whereas, in the absence of nervousness, a mild eczema without itching is nearly always observed. Czerny then proceeds to prove his hypothesis by diminishing the amount of milk in the food and by abolishing eggs from the diet.

It will be said at once that this clinical conception of exudative diathesis is not based upon experimental proof, that it is merely a speculation, and while it serves as a working hypothesis for carrying out certain lines of treatment, it has no foundation in pathology. Like all hypothetic considerations, however, it is useful as a temporary classification and serves as a basis for treatment. It is to be doubted whether it will have a permanent place in nosology.

It is possible that many of the obscure, irritative coughs without ascertainable physical signs depend upon an itching condition in the throat similar to that which occurs on the skin as a result of eczema. Similarly, pseudocroup may be the result of an angioneurotic edema.

Relation of Asthma to Other Diseases.—*To Spasmophilia.*—R. Lederer[1] calls attention to this form of bronchial spasm. In children suffering from spasmophilia the bronchial muscles are frequently subjected to tonic spasm, as a result of which there seems to be closure of the bronchi, more particularly of the smallest branches which communicate with the alveoli, causing a closure of the minute air vessels. In consequence, the alveoli collapse and atelectasis occurs. This condition may occur alone or may be associated with other constitutional manifestations of spasmophilia. One may conceive it as being analogous to the

[1] Zeitschrift für Kinderheilkunde, vol. vii, p. 129.

edema which occurs in association with the carpal and pedal spasm in tetany, *i. e.*, an edema of the bronchial mucosa. Or, indeed, it may be assumed that free fluid is poured into the lumen of the bronchi.

Concerning the frequency of this variety of bronchial spasm we may quote Lederer's figures: 5903 cases were treated in the hospital and 767 in the dispensary during one year. Of this number, 58 cases of spasmophilia that came under observation. The youngest patient was two months, and the oldest three years. Of these 58 cases, 6, or about 10 per cent., showed spasmodic symptoms of the bronchial musculature. These children responded to the electric tests and the Chvostek and Trousseau signs characteristic for tetany. Of the 6 cases which Lederer reports, all terminated fatally. The children all showed the typical symptoms of tetany, such as laryngismus stridulus, carpopedal spasm, Chvostek sign, and an increased electric excitability.

The condition of these children is typical. The breathing is labored and gasping; the alæ nasi dilate, and there is marked retraction of the ribs and sternum. Physical examination shows dulness over the posterior portion of the thorax which extends forward into the axillæ. Over the anterior portion the resonance is almost tympanitic in character. The lower margin of the lungs have descended, and the heart dulness is almost obscured by lung resonance.

Over the dull area, posteriorly, bronchial breathing is heard; anteriorly, vesicular breathing is elicited. The temperature varies from 100½° to 102° F. The condition remains unchanged for about three days. On the third day the cyanosis is extreme. The breathing is accelerated and noisy and may be heard at a distance. Over the dull area numerous small and middle-sized râles may be heard, and with increasing cyanosis, dyspnea, and cardiac weakness, death usually takes place.

At other times children may show manifest rickets, with gastro-intestinal symptoms and moderate spasmophilia. For several days there may have been indication of bronchial spasm, as shown by the severe dyspnea, dilatation of the alæ nasi, re-

traction of the thorax, and loud respiratory sounds. Eventually an attack of laryngismus occurs which is severe and protracted, and usually terminates fatally. Occasionally the attacks show interruptions. They tend to repeat themselves with the manifestations already referred to. Eventually symptoms of asphyxia occur, leading to a lethal result.

The diagnosis presents great difficulties, especially as between a bronchial spasm and a pneumonia. The explanation of the dulness which occurs posteriorly in these cases has been shown to be due to an atelectasis of the lung tissue. The *x*-ray examination tends to assist markedly in the differentiation. The picture lacks evidence of infiltration which characterizes a pneumonia. It shows well-circumscribed shadows between which dark tissue is situated.

The cases which have come to autopsy have shown characteristic pulmonary atelectasis. The posterior parts of the lung are of a dark bluish-red color, the surface is smooth and shiny, and the consistency is increased. The bluish-red color may involve an entire lobe or may be limited to smaller areas. In the regions which have not collapsed a vicarious emphysema is observed. The location of the atelectatic areas corresponds with the region which was dull upon percussion.

The microscopic examination shows that the walls of the alveoli have collapsed and lie close together and that the lumen has been obliterated. The contained cells have the character of normal endothelium. The blood-vessels show an increased content of blood, but nowhere is there any sign of active inflammation. Round-cell infiltration, which would indicate a possible pneumonia, is entirely absent. The bronchi show normal epithelial structures and no inflammatory secretion in their lumen.

The disease manifestation depends upon a spasm of the unstriped muscles of the bronchial tubes. It may be compared to the condition which causes carpopedal spasm. Owing to the spasm, the lumen of the bronchi becomes obliterated, and the communicating alveoli are cut off from their air-supply. Since these conditions may last for hours, days, or even longer, the

contained air is resorbed, the alveoli collapse, and their walls come in contact. In other words, the lungs become atelectatic. The atelectasis may occur either in small areas or be diffusely spread over a considerable portion of the lung.

Lederer considers this condition distinct from asthma, principally because it begins differently, and also because it remains uninfluenced by the administration of adrenalin. On the other hand, the differentiation of bronchotetany and asthma is not so simple a matter as Lederer would have us believe. Bronchotetany has many more points of resemblance to asthma than it has to bronchopneumonia. The most characteristic sign of bronchotetany is the extreme dyspnea. A large part of the bronchial musculature is in severe tonic spasm, so that the entrance of air and oxygen into the lung is prevented. The occurrence of atelectasis is a secondary affair, due to the bronchial spasm. It is also true that mild forms of bronchotetany may occur, involving smaller portions of the lung, with less extensive atelectasis.

It is a well-known fact that asthma occurs in two forms: first, the genuine asthma, which is not found frequently in young infants; and secondly, an asthmatic bronchitis. The first form—*i. e.*, the genuine asthma—may present the same symptoms as the bronchotetany without the extensive dulness. On the other hand, it is not conclusively shown that the asthmatic bronchitis may not in some instances depend upon spasmophilia. The important point is that a clinical asthma may occur on the basis of spasmophilia.

Asthma Associated With Nasal Lesions.—It is maintained that nasal lesions, such as occur, for example, in ethmoidal disease, are capable of producing asthmatic attacks. It has been shown experimentally on animals that if the posterior portion of the nose be stimulated, the lungs become dilated and rigid. If, on the other hand, the same mucous membrane be cocainized, this condition in the lungs disappears. As a general rule, the observation holds good in children that asthma is usually preceded by bronchitis, which, in turn, is preceded by an acute rhinitis. As a result of the progress of the catarrhal

infection, a spasm of the bronchial muscle takes place followed by the perverse type of breathing.

Attention has been called in recent publications to the possible relation of asthma to rachitis of the nose. As yet, however, nothing definite is known about this condition. By observation of the noses of rachitic children it has been pointed out that the condition occurs at the point where the cartilage and the small bones of the nose come in contact. In the rachitic nose the small bones undergo the same changes and show nodes similar to those which are observed in the ribs. They may also show a condition of subluxation. In nasal rickets, moreover, the mucous membrane shows a chronic cell infiltration.

It is reported by careful observers that nasal rickets is often complicated by bronchial asthma. The reflex neurosis producing the asthma may originate from any part of the mucous membrane, but particularly in the hyperemic area covering the rachitic nasal bone. It may be remarked incidentally that the nasal changes of rickets may be very pronounced when other manifestations are minimal or poorly developed, or when all other signs are wanting.

Walb[1] relates a typical case: A girl of eight years came to him with diffuse bronchitis, dyspnea, and definite symptoms of asthma. In the mucous membrane of the nose and the nasal pharynx a chronic catarrhal inflammation was found. These bones were deformed; the tonsils were hypertrophied; the teeth were markedly rachitic, and slight scoliosis was present. There were also large adenoid vegetations. After the removal of the adenoids and tonsils, the asthma still continued. In view of the suspicion of the rachitic condition of the nasal bones, the child was placed on an appropriate diet, and phosphorus and cod-liver oil were administered. She eventually made a recovery.

We may also in this connection refer to Kassowitz, who, up to the present day, has been the foremost student of rickets. He considers that asthma is in some way or other a complication of rickets, though he makes no reference to the nasal origin. He

[1] Rachitis of the Nose and Its Relation to Asthma, Deutsche Med. Wochenschr., 1913.

records a case of a markedly rachitic child, fourteen months of age, who presented loud bronchial râles and marked dyspnea. Under treatment with phosphorus and cod-liver oil the patient promptly recovered not only from the rickets, but from the asthma as well.

Other Diseases in Which Symptoms of Asthma are Present.—Enlarged bronchial glands may give rise to severe dyspnea which may simulate bronchial asthma. In young infants an enlarged thymus may cause a varying degree of dyspnea, which may also suggest an attack of bronchial asthma. In the more severe cases of thymus compression there are symptoms of tracheal stenosis, with retraction of the epigastrium and the upper portion of the sternum. Cyanosis is a common symptom. The enlarged thymus can be demonstrated by a physical examination and by the *x*-ray.

Asthma of cardiac and renal origin requires no special consideration at this point.

Symptomatology.—Asthma may occur in children at almost any age. Clinically, we may recognize two main varieties: first, those cases which are associated with bronchitis; and secondly, those which are characterized by sudden onset, usually accompanied by pulmonary emphysema, and in which there is a tendency to periodic recurrences. In the first form the disease begins with marked bronchitis, fever, lassitude, rhinitis, restlessness, and even delirium. Anorexia and vomiting may occur. Fever may reach a considerable degree. The pulse is frequent. The dyspnea, however, is the most characteristic symptom. Respirations may be 50 to 80 and even higher per minute.

The dyspnea is usually expiratory in character. The breathing is loud and noisy. The inspiration in most cases seems somewhat more free and less obstructed than the expiration, which is longer and whistling in character. If one inspects the thorax, he is struck by the immobile appearance of the chest during expiration, a condition resembling the emphysema of adults. The cough is usually persistent and disturbing; the breathing continues noisy. One has the feeling that there is considerable secretion. The younger children, however, do not expectorate it. If

the patients vomit, mucus may be seen in the vomited material. If the chest is examined, one hears numerous dry, whistling, sibilant râles. Sometimes percussion reveals an emphysematous character of the lungs. In infants the possibility of a capillary bronchitis should be considered.

The following case illustrates the condition as described above:

A. C., male child, age eight months, was admitted to the hospital because of dyspnea, cough, fever, and prostration. About four days ago the mother noted that the respirations became rapid and jerky, and the child had great difficulty in breathing. At times he became cyanotic. The respiration was wheezy in character, so that it could be heard at a considerable distance. The infant had been coughing for two weeks, during which time the cough had been non-productive, though the condition had become more severe during the past forty-eight hours. For four days the little fellow was greatly prostrated. He lay in bed breathing very rapidly, crying feebly, and refusing food. He seemed more comfortable when propped up on pillows. The mother informed us that he had had an attack similar to this four weeks previously; that he had had frequent colds since his birth, although he had suffered from no definite illness. His respirations were 72 per minute; pulse 160; fever 102.6° F. The blood examination, among other things, showed 18,000 leukocytes, with 78 polymorphonuclears. The examination was negative except for his lungs, which showed normal boundaries and were somewhat hyperresonant. Upon auscultation, one could hear over the entire chest every variety of dry râle, which were loud and penetrating and seemed almost constantly present.

The patient was given $\frac{1}{1000}$ gr. of atropin and $\frac{1}{60}$ gr. of codein every three hours for four doses; was fed breast milk and orange-juice and a small quantity of cereal. In two days the temperature became normal. The cough abated; and in a few days the patient had made a complete recovery.

Another patient, T. O., five years old, female, came for examination because during the past year she has had frequent attacks of bronchitis, accompanied by dyspnea. These attacks recur every week or two. The manifestations are typical asth-

matic spells. The dyspnea is severe and continues the entire night. There is no definite relation between the attack and the ingestion of any particular kind of food. Her temperature is 98.8° F.; she weighs 41¼ pounds. Examination of the urine shows a trace of albumin and 10 to 12 pus-cells per field, with an occasional clump of pus-cells. The blood shows 18,000 leukocytes, of which 38 are lymphocytes, two large mononuclear cells, 47 neutrophils, and 13 eosinophils. On examination she presents a dusky appearance. Her thorax is slightly emphysematous; and on auscultation, one hears numerous whistling, sibilant râles.

Another child, male, age nine years, was admitted to the hospital because of recurrent attacks of coughing. These spells occur every winter at intervals of about a month and last from twenty-four to forty-eight hours. They are more frequent at night than during the day. During the attack the child coughs frequently, complains of pain in the epigastrium, becomes markedly dyspneic, is unable to lie in a recumbent position, and is more comfortable when propped up in bed. The anorexia is almost complete. His temperature is 101.6° F., pulse 124, respirations 40. The parents maintain that all these symptoms have been present since the child was four weeks old.

The examination shows that the child has a barrel-shaped chest; the breathing is labored; the chest is in the inspiratory position; the respiratory excursions are very limited and hurried; the breathing is harsh, with numerous dry râles. The respirations are wheezing in character. The father has had recurrent asthma for years. The blood examination shows 9900 leukocytes, 80 neutrophils, 16 small mononuclears, 3 large mononuclears, and 1 eosinophil. The von Pirquet test is negative.

The second type of asthma as it occurs in children resembles in many respects the asthma of adults. The attacks tend to be recurrent and are present in every degree of severity. In many of the patients there is a definite neuropathic history in the family. Many of them are particularly susceptible to changes of weather. Some are attacked mostly in the winter; some have their attacks in the summer, associated with hay-fever. In some instances the asthma bears a striking relation to eczema, thus presenting

the condition which has been described by Czerny as exudative diathesis. Others are susceptible to certain kinds of foods, such as proteins, etc.

As a rule, children who have apparently been in normal health are suddenly attacked with severe dyspnea shortly after retiring. There is little or no cough. The breathing is rapid. The dyspnea may be intense. The chief trouble is expiratory, the chest being in position of full inspiration, so that strenuous efforts are made by the expiratory muscles to empty it of air. In severe cases there may be marked orthopnea. Cyanosis of varying degrees of severity is usually present, while fever is usually absent. The symptoms in most instances may be explained on the basis of obstructed breathing in the bronchi, interferences with pulmonary circulation, and accompanying emphysema. In the recurrent and chronic cases the facial appearance is suggestive. There is a tinge of cyanosis about the face, particularly the lips, and a dilatation of the small veins of the cheek and conjunctiva. The hands are cool; the pulse is rapid, often tumultuous or small. Sometimes the patient has involuntary passage of feces or urine. The alæ nasi become large on inspiration. The sternal notch and the epigastrium are retracted, and all the accessory muscles are in lively activity. On percussion, the lungs are hyperresonant and the normal excursion is diminished. On auscultation, loud, whistling, and sibilant râles are heard, which almost obscure the normal respiratory tones.

The expectoration contains Curschmann's spirals, Charcot-Leyden crystals, and eosinophil cells. The duration of the attacks is variable, lasting from a few minutes to hours or even days. They usually disappear as suddenly as they come. Some children may be perfectly normal between the asthmatic attacks. Sometimes, even though the attack disappears, a bronchitis continues. Some children do not quite regain their normal health in between times. They continue pale, show a degree of lassitude, and are irritable. As a rule, the attacks tend to disappear in later childhood, though sometimes they continue late into adult life.

Our records contain numerous cases of asthma in children of all ages. Some of them are attacked only during the hay-fever

season and are relieved by change of climate. Some are susceptible to one or another kind of protein food; some, to animal emanations, and in some the condition is chronic and occurs apparently after slight colds, attacks of indigestion, nervous excitement, or without reference to any definite exciting cause.

An interesting case is that of J. M., female, age four years eleven months. She was delivered by cesarean section, the mother dying three days after the birth of the child. The patient has been artificially fed since birth. Since she was seven months old she has had eczema, which disappears and returns at varying intervals. Asthmatic attacks began when she was about twelve months old. At first they recurred at long intervals, but after she was two years old the periods became shorter and the attacks more severe. At three years of age the child acquired whooping-cough. The combination of this disease and the asthma caused intense suffering and produced attacks of great violence which were marked by cyanosis, dyspnea, and respiratory distress. The child became greatly exhausted. She was unable to recline in bed and had to be supported in the sitting position in the arms of a nurse most of the day and night. The dyspnea and the discomfort continued almost without interruption. The heart became markedly dilated; the pulse weak and rapid; the cyanosis increased, and numerous râles were heard over the lungs, though the heart tones remained clear. This combined paroxysm of whooping-cough and asthma lasted for days at a time. The cough itself persisted for weeks, during which time there was an occasional abatement of the asthmatic manifestations. The child eventually recovered from the whooping-cough. The dry, broken eczema on the skin, however, persisted, and the asthma itself, after intervals of several days' absence, would recur, lasting for two or three days at a time. The patient obtained great relief by a prolonged visit to New Mexico, though the asthma recurred upon her return to Chicago.

The examination shows the child with a dry skin, broken here and there by fresh eczema patches, and a slightly bluish discoloration of the visible mucous membranes. The tongue shows map-like configurations on the surface, presenting the condition

known as lingula geographica. Examination of the thorax shows some involvement of the accessory muscles of respiration even during quiet breathing. The urine shows no pathologic findings. The blood shows 85 per cent. hemoglobin, 16,200 leukocytes, 40 lymphocytes, 4 large mononuclears, 47 neutrophils, 2 transitional, and 7 eosinophils. Percussion elicits a hyperresonant note. The respiratory excursion is diminished and the lung tissue overlies the normal cardiac area. The lungs are emphysematous. Auscultation gives evidence of a moderate degree of chronic bronchitis even during the quiescent periods. During an asthmatic attack the sibilant and whistling râles predominate over every other sound.

The food was changed and adapted in every conceivable manner without in the least affecting the course of the disease. During a severe paroxysm drugs exerted, for the most part, little or no influence. The greatest relief was obtained, temporarily, by $\frac{1}{60}$ to $\frac{1}{30}$ gr. of morphin hypodermically. The case also represents the clinical findings which are described under the caption of exudative diathesis.

Another case is that of a boy who was brought to me when eight months old with a severe eczema on cheeks, forehead, and wrists, which itched intolerably, so that he was awake and restless night and day. He was having 1 quart of milk daily. This food was reduced in quantity; cereals and broths were substituted. In consequence, the eczema improved so that the itching disappeared.

At eleven months of age asthma appeared and has persisted up to the present. The attacks occur most frequently in winter; seldom in summer. They come on after an acute cold, though the mother observes that they will also occur after indigestion or great fatigue. They are very severe in nature and last two or three days. The patient has marked idiosyncrasy against egg. Even the slightest trace of it in his food will bring on an attack. He is now seven years old. The attacks still continue, though they occur at long intervals. He is undersized, of insufficient weight, eats poorly, and is still sensitive to egg.

My colleague, Dr. J. H. Hess, furnishes me with a brief refer-

ence to a very interesting case of food asthma in a boy eight years of age, the son of a physician. The boy was subject to recurrent attacks of asthma, of which the father was unable to ascertain the etiologic factor. They usually came on during the early evening and lasted for about six or eight hours, increasing in severity in the course of the night. After each attack the little fellow became perfectly normal.

In endeavoring to ascertain the causal factor the feeding history was carefully investigated. It developed during the inquiry that the father himself disliked pork, so that it was never served while he was at home. The grandmother, however, confessed that whenever professional engagements necessitated the father's absence from home, the mother usually indulged in a pork debauch. The grandmother suspected that this food had something to do with bringing on the attacks, for whenever the boy ate pork he was seized with violent asthma. Two weeks after the attack mentioned the boy was given a roast-pork dinner as a test-meal. During the ensuing night he was again seized with a violent attack similar to the preceding one, thus proving without doubt his sensitivity to this article of food. Naturally, it has been omitted from the diet, and, in consequence, he has had no further attacks.

Prognosis.—As has already been indicated, many of these children afflicted with asthma tend to recover before puberty. In some the condition persists into adult life. The prognosis depends largely upon the permanence of the emphysema. If the attacks are of infrequent occurrence and the emphysema slight, the prognosis is favorable. When the attacks are of frequent occurrence, and the emphysema becomes extensive and firmly established, a chronic bronchitis occurs. The patients show more or less cyanosis and a persistent dyspnea. They are in permanent ill health and are likely to succumb to pulmonary or cardiac complications. It should be emphasized again, however, that these are the exceptional cases. The great majority that have come under our observation tend to recover permanently. The attacks, however, may be replaced by other nervous manifestations in later life, the most common of which is migraine.

The differential diagnosis of asthma must be made from con-

genital stridor, thymic asthma, pseudocroup, diphtheria, laryngitis of measles, whooping-cough, retropharyngeal abscess, enlarged bronchial glands, and foreign bodies and ulcers in the larynx.

Treatment.—Prophylaxis. The treatment of asthma in children calls for a most careful physical examination. The presence or absence of rickets, spasmophilia, disease of nose or throat, the presence of eczema, neuropathic taint, or an inherited disposition to the disease—all may have importance in the treatment.

In 1907 Besredka stated that calcium chlorid has the power to prevent anaphylaxis. Since then this discovery has been confirmed experimentally by others and has proved effective in preventing the occurrence of attacks. It is used in cases of spasmophilia in infants and in children of every age. It may be given for a long time with occasional intermissions of a week or two. Young infants of a year or less may be given 3 to 5 grains in watery solution four times daily.

In older children respiratory exercises are of value in connection with other hygienic measures, such as daily bathing, cool sponging, and a life out of doors. Patients should eat carefully and provide for a daily evacuation of the bowels. They should be spared nervous overstrain both at home and at school.

For the hay-fever patients relief is frequently obtained and tolerance increased by injecting pollen extracts derived from the special exciting plants. Goodale directs that the pollen be either placed in a solution for extraction or preserved dry for an indefinite period. A suitable extract constitutes a stock solution from which subsequent dilutions may be made. In order to determine the strength of the solution to be used for injection a skin test should be made. It should be stated, however, that in children under ten years of age who present well-defined symptoms of hay-fever, no skin reaction with the prevailing pollen will take place.

When possible, however, the special exciting pollen should be determined by the skin test. The initial dose of the injection should not exceed 5 to 10 drops of the aqueous extract of the pollen. The dose may be gradually increased drop by drop thereafter. Injections should be made at intervals of two days

to a week, and should in most cases be stopped before the date of attack, since the introduction of protein may cause an increase of symptoms at this time.

In cases where asthma occurs suddenly during hay-fever, removal to the mountains or to northern resorts gives prompt relief and is to be advised.

The local treatment of the nasal mucous membrane should be undertaken in every case where a pathologic condition exists. A normal nasal mucous membrane is less likely to absorb the specific protein than a diseased one. For this reason nasal polypi —chronic ethmoiditis—should receive prompt and appropriate attention, preferably by a specialist.

Treatment of the Attack.—Adrenalin solution in 1- to 2-drop doses of a 1 : 1000 solution frequently checks the attack. At times injection of morphin in doses of $\frac{1}{30}$ to $\frac{1}{20}$ gr., combined with $\frac{1}{1000}$ gr. of atropin, is required to control the paroxysm. Talbot has also suggested that in order to build up immunity against sensitizing proteins, children who show anaphylactic reaction to egg-albumen should be given minute doses of this protein, preferably in capsules, increasing the dose until the patient is immunized. Treatment by the use of autogenous vaccines has also been recommended. Where there is secretion from trachea or bronchi, the organisms are obtained by aspirating the secretion, isolating the organisms, and preparing the vaccines from this aspirated material. Although I have seen this method tried, I have never been convinced of its efficacy.

During the attack I have frequently seen temporary relief obtained by burning nitrate and stramonium papers. If everything else fails, the little patients receive the greatest benefit by a change of climate. I have frequently seen children for whom life was intolerable during the northern winter, who improved almost at once when removed to Arizona or New Mexico. Sometimes relief is obtained for these patients in Florida or California, though experience in each individual case determines the best locality. The hay-fever patients are relieved by removal to northern or mountainous regions, or occasionally by a sea-voyage or by trips to the sea-coast.

CLINIC OF DR. MAXIMILIAN J. HUBENY

CHICAGO POLICLINIC

ROENTGEN EXAMINATION OF THE APPENDIX

THE appendix is probably the worst maligner in the human race. While acute appendicitis presents certain difficulties in diagnosis, the chronic form is many times unrecognizable. From the roentgenologic viewpoint little need be said of acute appendicitis, except that occasionally one might be illumined in a left-sided appendicitis, several such cases having been reported. In such an instance an opaque enema, carefully given during fluoroscopic examination, will show if we have a case of transposition. It is a well-established fact that if a patient has once had appendicitis he will always be liable to suffer from another attack if the appendix has not been removed.

The function of the vermiform appendix seems to be in doubt; some regard it as a vestigial organ, stating that the vermiform process in man is the degenerated remains of the herbivorous cecum, which is associated with a large appendix, while the carnivorous cecum has a relatively small appendix. Others (Robinson) state that it secretes certain hormones which are quite necessary to stimulate the cecum, thereby provoking its contractions and expediting the issue of the feces collected. Keith's New Theory of the Causation of Enterostasis and the Theory of Sphincter Zones as the Pace-makers of Intestinal Peristaltic Activities advances the thought of a ceco-appendical plexus zone. It is considered that normally there is an intimate co-ordination in the rhythm of each successive segment of the entire intestinal tract, and that any disturbance, irritative or inflammatory, upsets this rhythm with reflex manifestations in the form of spasms. Thus, given an irritative lesion in the appendix, reflex spasm

occurs, and if permitted to continue over an extended period there is a progressive weakening or atony of the circular muscle-fibers which provokes an enterostasis. Such a view has recently been advanced by Ochsner. He states that clinical observations become more and more convincingly certain that the appendix possesses a peculiar neuromechanism which normally is exercised in the designed functional activities of the ileocecal region.

The foregoing remarks are made because of the desirability of determining whether we are dealing with a normal appendix or a diseased one. There should be no hesitancy of ablating an inflamed appendix; because of atypical symptoms it is often removed and found to be uninvolved, while the condition of the patient remains as heretofore. The appendix has frequently been removed when the real cause of trouble was a stone in the urinary tract, especially in the lower right ureter; tuberculous peritonitis, tubercular mesenteric glands, painful right inguinal hernia, pleurisy, pneumonia, cholecystitis, or disease of the tubes and ovaries.

It is an acknowledged fact that the cecum is grossly classified into four groups and that its location is variable. The appendix has a different point of relative origin in each type. This brings up the issue of McBurney's point, which exemplifies the acceptance of an opinion based on the law of average. Surgical interventions, postmortems, and roentgenologic examinations concur in the occasional instances of an unusually placed cecum and appendix. It is readily apparent that any method not associated with any hazards should be accepted as a diagnostic aid.

The object of this paper is to place confirmatory data in our hands, which, with other clinical findings, warrant a diagnosis of chronic appendicitis.

Holzknecht, Albers-Schoenberg, Beclere, Jordon, Groedel, Riedel, and other European roentgenologists did some early work on this subject; however, considerable credit must be given some of our American collaborators, notably Cole, Quimby, Imboden, George, and Case, for appreciating the possibilities of this method of examination.

There are two methods of visualizing the appendix: the first is by injecting an opaque enema; the second by the ingestion of an opaque meal. The second is preferable because of the greater frequency with which the appendix can be demonstrated. In examining the patient the fluoroscopic method is the most satisfactory, and this should be done in the vertical and horizontal positions.

By proper manipulation an otherwise hidden appendix can be shown; also movability and relationship to the surrounding structures noted. The plate method should also be used, for it occasionally gives additional information. Sometimes stereoscopic plates are indicated whereby one can trace a retrocecal appendix, or an appendix in close proximity to the cecum or ileum, which might otherwise be overlooked.

It is necessary that the lumen of the appendix be patent. The appendix may not be demonstrated if its lumen is obliterated, or if adhesions or kinks are present near the proximal end; or if an acute attack exists the infiltrated mucous membrane prevents the entrance of the opaque substance. Also an enterolith or previously contained matter may prevent its filling.

The writer has had the experience in several cases in which the first examination failed to reveal the appendix, but a second examination disclosed its presence.

The two possible factors in filling the appendix are antiperistalsis in the ascending colon and sedimentation.

Groedel has recently asserted that every appendix which permits the entrance of an opaque meal is pathologic. However, the more rational assumption is that if the appendix empties itself at the same time that the cecum does, it should not be considered diseased, for Moro has cinematographically demonstrated peristalsis in the appendix of a dog similar to that which exists in the cecum. Cohen says that cecal contents normally enter the appendix; it should, however, be empty when the cecum is empty. He states it may fill and empty itself several times during the same opaque meal.

The time of examination is important, for the appendix commences to fill shortly after the cecum. This is usually after

six hours, although there are cases that fill earlier. From this time on until the bowel is empty, and often for several days afterward, the appendix remains visible. Pirie has reported one case in which the shadow persisted for forty days.

Pathologists inform us that the evidences of previous appendical inflammation are peritoneal adhesions, obliterations of the whole or portions of its lumen; strictures of the lumen with more or less dilatation distal to it, and lastly, the presence of hard concretions which are retained by strictures or produce the same effects as strictures.

Concretions may occasionally be shown. The other factors are inferential from the following information: The visualized appendix with fluoroscopic manipulation will give us: (1) the size, including the length and calibre; (2) position and direction; (3) drainage; (4) mobility; (5) kinks; (6) the location of applied pressure to visceral topography. This latter point is quite important, for should pain be constantly elicited by pressing on the appendical shadow, one is justified in suspecting its involvement, for seeing palpation is more valuable than palpation without seeing. Crane has stated that if a constant point of tenderness located on the cecum approximating the site of the appendix be elicited, even though the appendix is not visualized, it would justify the conclusion of an inflamed appendix.

In palpation great care must be exercised, for if too vigorous, traumatic sensitiveness might be produced, thereby misleading one into concluding that the pain or sensitiveness is inflammatory. This is quite important, and if appreciated will reduce the possibility of error. This often throws light on cases in which anomalous symptoms have resulted from the appendix being situated in the pelvis, behind the cecum, or unusually high, when the symptoms may simulate gall-stones or duodenal ulcer or vesical involvement.

Fluoroscopically the presence of adhesions in connection with the appendix, terminal ileum and cecum, whether to each other or the surrounding parts, can often be recognized, especially if they are extensive. If the cecum is in the pelvis it can often be drawn into the right iliac fossa. When this cannot be

done, it is impossible to determine whether adhesions are present, as the cecum and appendix are too deep to be palpated satisfactorily unless the colon is distended with air or the bladder is not emptied for ten or twelve hours; sometimes the Trendelenburg position releases a mobile cecum so that the appendix is palpable and visible.

The appendix produces effects on remote organs. The stomach may be hypertonic, so that it empties itself rapidly. This is much less frequently observed than with duodenal ulcer. More commonly a spasm occurs in the center of the stomach. Indeed, chronic appendicitis is, after gastric ulcer, the most frequent cause of spasmodic hour-glass constriction of the stomach. Sometimes pressure over the appendix will produce a spasm; in most cases epigastric discomfort was simultaneously produced. Barclay declares that appendicitis causes an impairment of the ileopyloric reflex, producing appendix dyspepsia. Occasionally we have associated a delayed pylorospasm. Intestinal stasis is sometimes the result of adhesions following a chronically inflamed appendix.

Stasis of the cecum and ascending colon is often due to reflex inhibition resulting from chronic appendicitis. In such cases the cecum and an ascending colon are often abnormally large and unusually mobile.

Enterospasm, usually affecting the proximal half of the transverse colon, is sometimes present.

When the appendix hangs over the brim of the pelvis, or when the cecum as well as the appendix is situated in the pelvis, chronic appendicitis may produce dyschezia (Hurst).

CLINIC OF DR. HENRY F. HELMHOLZ

CHILDREN'S MEMORIAL HOSPITAL, CHICAGO

PYELITIS IN THE NEWBORN

PYELITIS in infancy has been emphasized by practically all writers on the subject as one of the most frequent causes of obscure fever. Most observers are agreed that the condition is relatively more frequent among baby girls than among baby boys. As regards pyelitis during the first few weeks of life the literature is singularly barren. Only a single publication by Kovalesky and Moro[1] was found. They described 2 cases of pyelitis in the newborn. The youngest of the two was a weak, subnormal boy of eight days, whose urine contained a large number of pus-cells, blood, and albumin. Culture taken from the urine showed the presence of a Bacillus coli. The illness terminated on the eleventh day as the result of a Bacillus coli septicemia. Von Reuss, in his book on The Newborn, thinks that pyelitis is probably more frequent in the newborn than in the older infant, because of the frequency of generalized infections in the first few days of life. He says, however, that clinically the evidence for this fact is still lacking.

In view of the relative infrequency with which cases of pyelitis have been described in the newborn, it seemed of interest to describe 3 recent cases of pyelitis that have come under the observation of my associate, Dr. Sauer, and myself. Contrary to the general rule that pyelitis in infancy is more frequent in baby girls than in baby boys, these 3 cases are all in boys. The diagnosis of pyelitis was made in one case on the sixth day, in the second case on the tenth day, and in the third case on the

[1] Kovalesky and Moro, Ueber Zwei Fälle von Koliseptikämie bei Neugeborenen., Klin. therap. Wochenschr., 1901, No. 50.

fifteenth day. In each instance the diagnosis was made the first time the child was seen, so that it is difficult to say in each instance how long the condition had existed beforehand. In all three cases it is probable that the pyelitis had existed for some days before its discovery, because the urinary findings were those of a well-established case of pyelitis. In all the cases there was nothing in the symptomatology of the physical findings that would have led one to suspect a pyelitis, unless it were the absence of anything to explain the fever in the first two cases. The diagnosis in each instance was the result of urinary examination.

Whether we have been overlooking cases of this kind in years gone by, or whether it is one of those peculiar coincidences in medicine that we should have seen 3 cases of this kind in a period of six weeks, it is difficult to say, but it can be said that these are the first cases in the newborn that we have seen in ten years of practice.

The 3 cases in detail were as follows:

CASE I.—Baby boy S. was born November 13, 1917, with a birth weight of 9.6¼ pounds. The child lost considerable weight during the first twenty-four hours; its weight being only 8.6 pounds on the second day. The following day it developed a temperature of 103° F. and the weight dropped to 8.3 pounds. For a period of about a week its temperature continued normal, and the child's weight remained stationary on a combination of breast milk and modified cows' milk. On the 23d it was circumcised, and three days following the temperature again went up. The weight now dropped to 7.15 pounds. The temperature varied from 97.6° to 103° F. The bowels, which had been kept open with almost daily doses of oil, became very loose and frequent. On the 29th and 30th the temperature varied between 100° and 104° F. The stools remained green and the child was in a very critical condition, cyanotic skin, turgor poor, marked tympanites. On December 1, 1917, the child's temperature was 102.4° F.; the stools were loose, green and watery, and child appeared to be suffering from an acute gastro-enteritis. At the first examination the child was catheterized and a small amount of turbid urine was ob-

tained containing a large number of pus-cells; marked positive test for albumin, and on culture yielded a pure culture of Bacillus coli. The weight on this day was 7.11 pounds. The child was put on 5 grains of sodium bicarbonate and 5 grains of sodium citrate every three hours. Water was forced by mouth and saline solution given by rectum. Albumin-milk (1½ ounces) was given every three hours by mouth. The following day the temperature remained at 102° F. and the weight dropped to 7.9 pounds, but with the increased amount of fluids the child seemed somewhat better. During the next three days the temperature still varied between 99.8° and 102.4° F. Urinary examination: Albumin +++, pus-cells +++, red blood-corpuscles +, hyaline and granular casts +. On the 4th of December urine was alkaline, contained a trace of albumin, pus-cells +++, and an occasional red blood-corpuscle, but no casts. On December 12th the temperature was normal. Albumin-milk had been increased to 3 ounces and the weight was gradually increasing. On the 7th there was still a trace of albumin and ++ pus-cells in the urine. From that time on the child continued to gain. The pus-cells in the urine gradually subsided, and by January 1, 1918, the urine was practically normal. Since that time repeated specimens of urine have been obtained, all of which have shown practically normal findings.

CASE II.—Baby boy S., born December 5, 1917, with birth weight of 8.14 pounds. Child was born at the Evanston Hospital, where it remained four days. Child was breast fed every four hours. Child was doing well at the breast, keeping its food down and sleeping well at night. Stools had rather typical hunger-stool appearance. There was a slight infection of the cord when seen for the first time on December 15th. Temperature was 102.5° F. The urine on that day was strongly acid, albumin +, pus-cells +++. Gram-negative bacilli were found in pure culture. The temperature continued to run between 97° and 103° F. Abdomen was rather tense. There was no vomiting. December 18th, 19th, and 20th temperature varied between 97° and 102° F. The urine was now alkaline; pus still present +++. Culture showed pure culture Bacillus coli. The temperature on the 22d became nor-

mal and has remained so ever since. The urine contained pus until February 1st, when the urine became entirely free from pus. The child was fed on a mixture of albumin-milk and water, half and half, 3½ ounces, six times a day. On the 12th of January the weight had returned to 8.7 pounds; on the first of February, to 9.8 pounds. Specimens of urine obtained on several occasions after this showed a perfectly normal urine. On the 7th of March the child weighed 11.3 pounds, and was gaining on a simple milk dilution mixture.

CASE III.—Baby boy B., born January 2, 1918. Normal birth. For the first twenty-four hours seemed perfectly normal. After that time had some difficulty in retaining its food. Birth weight 9.1 pounds. Temperature after the third day ran slightly above normal, on one occasion reaching 100° F. The case was seen for the first time on January 7th, at which time the weight was 9.1 pounds. The child was still regurgitating slightly, but the bowel movements were normal. It was receiving six feedings at the breast. Physical examination was entirely negative. Examination of urine showed +++ leukocytes, + red blood-corpuscles, and culture of urine showed pure culture of Gram-negative bacilli. Except for the fact that the temperature was slightly above normal the child showed no symptoms whatsoever. The child was given 10 grains of sodium citrate, well diluted in water three times a day. Two days later the temperature returned to normal and has remained so ever since. The regurgitation continued, but with that exception the child made an uneventful recovery.

As is seen from the histories, all 3 cases were in boys, and in all 3 cases a colon bacillus was isolated in pure culture. In the one instance, Baby B., in which the diagnosis was made on the sixth day, there was practically nothing in the history of the case or in the physical examination that might explain the source of the infection. We have a case of pyelitis in an otherwise perfectly healthy boy baby, weighing 9.1 pounds at birth. In the second case as a possible source of infection we have an infected navel. Unfortunately, cultures were not taken from the navel, but in all probability the infection was with a member of the coccus group

rather than the Bacillus coli. This corresponds to our experience in older infants, in which, when pyelitis complicates an infection of the tonsil, skin, or other organ, the infecting organism is usually the Bacillus coli and not the organism found in the original infection. The third instance is the one in which the child was circumcised. The fact that the pyelitis developed shortly after circumcision makes it seem possible that the operation had something to do etiologically with the pyelitis. The toxic condition that this last infant was in when seen for the first time was probably due to the pyelitis primarily, and the nutritional disturbance probably secondary to the pyelitis aided in its production. It is striking that these 3 cases and the one reported by Kovalesky and Moro were all in boys. The ease with which an organism passes through the intestinal wall in the early days of life make it seem probable that the organisms gained entrance from the bowel and were carried to the kidney by way of the blood-stream.

The symptomatology, as is usual in these cases, shows wide variations, and practically nothing was seen clinically that would call attention to the urinary tract. In two instances there were practically no symptoms, and in the third case the symptoms which were observed were of the gastro-intestinal canal. The clinical picture of none of the 3 cases was suggestive of a probable pyelitis. In all three instances there was a slight rise of temperature; in the one instance never above 100° F., in the other two up to 102° and 104° F. As is so frequently the case in pyelitis of older infants, in Case I the gastro-intestinal symptoms completely dominated the symptomatology, and until an examination of the urine was made the child was supposed to be suffering from an acute gastro-enteritis. The rapid recovery after the institution of the treatment and the increase in weight after the second day of treatment are strongly in favor of the fact that whatever gastro-intestinal trouble was present was of relatively mild grade, and that toxemia and prostration were due to the pyelitis rather than to gastro-intestinal absorption.

The diagnosis in each instance was made by an examination of the urine. This point cannot be emphasized enough. The

frequency with which febrile disturbances are encountered in the first few weeks after birth makes it absolutely essential that in every case, male or female, pyelitis be excluded. Although most frequently seen in the female sex, these 3 cases show that in the newborn at least pyelitis is just as common in the male as in the female. There are means available by which specimens of urine can be readily obtained from boy and girl babies, and it is essential that in all febrile conditions of the newborn the urine be examined. .

As regards the therapy, the alkaline treatment was entirely successful in each instance. As can be seen from the figures, 5 grains of sodium bicarbonate and 5 grains of sodium citrate were given every three hours until the urine was alkaline. Then the dose was gradually reduced, keeping the urine definitely alkaline. Of even greater importance is the necessity of giving large amounts of fluid. The beneficial effects of this were seen particularly in Case I.

To sum up: 1. Pyelitis in the newborn is probably very much more common than we suspect at the present time.

2. The clinical picture shows the same wide variations that it does in later infancy.

3. The alkaline treatment, together with the forcing of fluids, proved successful in these three cases.

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Manual of Diseases of the Nose and Throat. By ALGERNON COOLIDGE, M. D., Professor of Laryngology, Harvard Medical School. Octavo of 360 pages, illustrated. Cloth, $1.50 net. **Published September, 1915**

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